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24 MAY 1967

DEPARTMENT OF AGRICULTURE
NEW SOUTH WALES

1966

PARLIAMENT OF NEW SOUTH WALES

REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

Year ended 30th June, 1966

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ADMINISTRATIVE AND SENIOR SUPERVISORY PERSONNEL*

As at 30th June, 1966

Minister for Agriculture	Hon. W. A. Chaffey, M.L.A.
Director-General	Mr R. M. Watts.
Deputy Director-General	Dr F. C. Butler.
Secretary	Mr J. L. Hager.
Accountant	K. A. Russell.
Administrative Assistant (Personnel)	S. W. Wise.
Pastures Protection Officer	D. McGregor
Legal Officer	S. T. Beal.
Architect	B. A. Chadwick
Chief Biometrician	F. C. McCleery.
Chief Research Liaison Officer	Dr S. L. Macindoe.
Division of Plant Industry—	
Chief	W. H. G. Poggendorff.
Deputy Chief	A. C. Orman.
Principal Agronomist (Research)	L. R. Kavanagh.
Principal Agronomist (Extension)	G. Nicholson.
Principal Agronomist (Pastures)	W. T. Atkinson.
Principal Agronomist (Miscellaneous Crops)	F. W. H. Cutting
Division of Horticulture—	
Chief	B. O. French.
Deputy Chief	R. G. S. Kebby.
Principal Fruit Officer (Extension)	E. C. Connor
Principal Fruit Officer (Research)	J. K. Long.
Principal Fruit Officer (Viticulture)	G. R. Gregory.
Senior Inspector (Export and Import Branch)	R. W. Robertson.
Division of Animal Industry—	
Chief	R. A. Hall.
Deputy Chief	N. K. Golding.
Director of Veterinary Research	J. C. Keast.
Principal Veterinary Research Officer	E. J. H. McBarron.
Chairman, Board of Tick Control	J. N. Henry.
Director of Cattle Tick Research	Dr R. N. McCulloch.
Principal Veterinary Officer	D. G. Christie.
Principal Veterinary Officer (Extension)	J. S. Healey.
Principal Veterinary Officer (Meat Inspection)	R. C. Cramp.
Principal Livestock Officer (Sheep and Wool)	C. J. Hawkins.
Principal Livestock Officer (Beef Cattle, Horses and Goats)	W. J. B. Murphy.
Principal Livestock Officer (Pigs)	N. A. Steel.
Principal Livestock Officer (Poultry)	Vacant.
Principal Livestock Officer (Apiculture)	A. A. Clemson.
Division of Dairying—	
Chief	D. W. Crowfoot.
Deputy Chief	C. E. Chapman.
Principal Dairy Officer	E. G. McLaren.
Principal Dairy Officer (Herd Improvement)	D. R. Scott.
Principal Dairy Officer (Hawkesbury Agricultural College)	Dr G. J. F. Smith.
Division of Science Services—	
Chief	Dr C. J. P. Magee.
Chief Biologist	W. S. Sutton.
Chief Entomologist	P. C. Hely.
Chief Chemist	T. H. Johns.
Director of the Royal Botanic Gardens and National Herbarium and Chief Botanist	H. K. Mair.

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* For more detail of staff of the various Divisions, Branches, etc., see New South Wales Department of Agriculture brochure *Directory of Officers*.

For staff number totals see tabulation in this Report, page 17.

ADMINISTRATIVE AND SENIOR SUPERVISORY PERSONNEL

As at 30th June, 1966—*continued*

Division of Information Services—

Chief	H. Parry Brown.
Editor of Publications	W. R. Turner.
Special Extension Officer (Agricultural Bureau and Group Work)	J. J. Slater.
Senior Extension Officer (Women's Service)	Miss N. M. Foskett.
Research Liaison Officer (Scientific Publications)	J. N. Potter.
Librarian-in-Charge	J. C. Hazell.

Division of Marketing and Agricultural Economics—

Chief	C. J. King.
Principal Economics Research Officer	P. C. Druce.

Hawkesbury Agricultural College—

Principal	B. Doman.
Deputy Principal	W. J. C. Hudson.
Farm Supervisor	T. Adams.

Wagga Agricultural College and Experiment Station—

Principal	B. F. Atkins.
Deputy Principal	J. R. Sutherland.
Farm Supervisor	J. C. Ballantyne.

Wagga Agricultural Research Institute—

Director	Dr A. T. Pugsley.

Regional Extension Services—

Chief	J. L. Green.
Regional Supervisors of Agriculture—	
Southern Region	R. C. Madsen.
North Coast Region	F. Autry-Hall.
Western Region	B. D. Ament.
South Coast and Tablelands Region	R. W. Shelley.
South Western Region	E. Tindale.
Northern Region	G. R. Godden.
Mid Coast and Hunter Region	N. W. Vane.
Mid Western Region	F. J. Nicholson.
North Western Region	H. P. Hall.

Research Stations—

Chief, Research Stations Branch		A. Pearson.
Principal Officer (Management)		E. C. Powell.
Bathurst Agricultural Research Station	Manager	J. R. Davison.
Condobolin Agricultural Research Station	Manager	K. V. Simmons.
Cowra Agricultural Research Station	Manager	J. M. Arthur.
Dareton Horticultural Research Station	Manager	J. W. Turpin.
Glenfield Veterinary Research Station	Director	J. C. Keast.
Grafton Agricultural Research Station	Manager	C. E. Collins.
Griffith Viticultural Research Station	O.I.C.	A. F. Murray.
Leeton Agricultural Research Station	Manager	C. R. Hood.
Narrabri Agricultural Research Station	Manager	D. A. Pearson.
Narara Horticultural Research Station	Manager	L. F. Mandelson.
Agricultural Research Station, Glen Innes	Manager	R. I. Johnson.
Poultry Research Station, Seven Hills	Manager	R. N. Macindoe.
Tamworth Agricultural Research Station	Manager	J. A. Loveridge.
Tamworth Agricultural Research Station	Director of Research	Dr W. V. Single.
Temora Agricultural Research Station	Manager	R. Thomson.
Trangie Agricultural Research Station	Manager	G. G. Darling.
Wollongbar Agricultural Research Station	Manager	J. C. England.
Yanco Agricultural College and Research Station	Manager	F. D. Mackenzie.
Alstonville Tropical Fruit Research Station	O.I.C.	C. A. Eady.
Dairy Industry Research (North Coast)	Supervisor	Dr F. G. Swain.

NEW SOUTH WALES

DEPARTMENT OF AGRICULTURE

Report of the Director-General to the Minister for the Year ended 30th June, 1966

Department of Agriculture, Sydney, 19th September, 1966.

Dear Sir,

Herewith the Report of the Department of Agriculture for the year ended 30th June, 1966.

CENTRAL ADMINISTRATION NOTES

The Drought

The dominant factor in rural activities in New South Wales throughout the past twelve months and extending back to December/January of 1964–65 has been drought. Drought has prevailed over production in most districts, with the possible exception of the irrigation areas and some favoured places on the far north coast. Some rains have been received, but in no area can it be safely stated at 30th June, 1966, that the drought has broken. Widespread, soaking rain is needed to replenish subsoil moisture and farm-water supplies.

The drought in many areas has been the worst in memory, and in other places the worst since 1902. Stock losses have been very heavy and loss of production and forced sales have further added to the burden of producers. The production of grain and fodder crops, after the record year of 1964, has been one of the lowest ever. The cost of all this has been variously assessed, and it is impossible to place an accurate figure on the losses. Probably $250,000,000 would be conservative.

There are 59 Pastures Protection Board Districts. At one stage 46 of the 59 Districts were proclaimed Drought Areas. At 30th June, 1966, thirty-nine still were proclaimed.

The drought had started in the Western Division early in 1964 and had become acute throughout the northern half of the State by early 1965. It followed one of the best agricultural seasons experienced in New South Wales. The 1964 season had yielded a record wheat crop of 152 million bushels, record wool production, record cotton production, and, if not records, at least high level production in many other lines of production.

Sheep numbers were at a record high, almost 72 million. Beef and dairy cattle totalled 4,798,000, also a record. But the amount of stored fodder was lamentably low to feed them in those numbers through a long drought. Hay stored on farms amounted to only 1,610,000 tons and normal practice would be to use over one million tons a year for general feeding of stock. Silage stored was only 565,457 tons.

On the pleasing side was the quantity of oat-grain stored on farms, 25,088,304 bushels; a record. And there were few rabbits, record wheat-stocks in country silos, big stocks of wheat in silos on many farms, ample road and rail transport for stock and fodder, and seemingly fair water supplies.

Stock-losses through the drought have been surveyed on a Shire basis. The survey has revealed the following figures: Sheep reduced by 9,712,000,* from 71,764,000 to 62,052,000; beef cattle reduced by 864,000,* from 3,681,000 to 2,817,000; dairy cattle reduced by 118,000,* from 1,108,000 to 990,000.

The lack of rains adequate to promote normal pasture growth showed up the normal farmer's unpreparedness for a long period of feed-shortage. The rate at which water supplies ran out on many properties, due not only to lack of rain, surprised. Maintenance of tanks, dams, wells and springs proved to be quite inadequate. A late attempt to overcome these deficiencies was only moderately successful. Many new tanks, dams and other water sources have been developed as a result of the experience.

Coupled with efforts to arrest the alarming decline in stock water was the attempt to expand or introduce irrigation on the property in the hope that feed of some sort could be grown, at least to keep stock alive. The outstanding resort was Sudax. This hybrid sorghum was planted in a wide variety of soil types and climatic districts. In general it proved a striking success. Oats and nitrogen were also of outstanding value in this time of stress.

The efforts made with and the success of hand-feeding have been further highlights of the drought. Because of lack of paddock-feed, a large percentage of stockowners were forced to hand-feed. Reserves on most properties were totally inadequate to meet the prolonged period of need.

Many approaches were applied to handling the drought: from letting stock die; sales of all or part of the flock or herd; agistment; scrub-cutting; use of hay, silage and grain. Because of the general cover of the State by the drought, agistment was expensive and hard to find.

Hay prices gradually increased up to about $100 a ton in the paddock and then came back to $40–60. This form of feeding was very expensive on a protein or feed-unit basis, even if enough hay were available.

Because of the previous year's record wheat-harvest, adequate stock of this grain were available, and proved to be the backbone of the feed-programme. Other grains were used where available, with equal success. In some cases oats were sold at over $1 a bushel and were expensive compared to wheat at $1.50.

The circumstances having forced farmers and graziers to hand-feed purchased hay and grain, they have now better understanding of the feeding-value of the various fodders. It is hoped that their present intention to grow and store more fodder will be implemented.

To assist New South Wales producers, Victorian and South Australian farmers generously donated hay and funds to purchase such fodder as sheep nuts.

However, financial and other assistance from Government sources provided the main body of help and relief for those suffering critically from the drought.

The 75 per cent rail rebate on freight charges for fodder encouraged purchase of feed, since rail transport under this provision did not add greatly to the actual fodder-cost. Road tax under the State Transport (Co-ordination) Act was waived and road transport of hay was subsidized. Western Division graziers received special consideration through subsidies for road transport of fodder.

By financial aid through the Government Agency Department of the Rural Bank, using funds supplied by the State Government, many farmers in difficult circumstances received their greatest help. The $6,000 "carry-on" loan on very generous terms and enabling the farmer unable to get money from other sources to obtain a loan to purchase everyday necessities, has been invaluable. A total of $10 million has been loaned under this scheme, to 2,500 necessitous farmers.

Movement of 1½ million bushels of wheat from the south to the northern system; money to local government Councils and other authorities in declared Drought areas, to provide relief employment; financial aid to purchase wheat; and the recent scheme to provide loans of up to $10,000 for purchase of stock, are further examples of the range of practical actions taken to provide relief during the drought.

The drought imposed heavy demands, also, on the extension services. Extension officers were naturally called upon to provide additional advice to farmers on methods of feeding, but in some areas many hundreds of hours of personal time were worked also by officers in organizing receival and distribution of gift-fodder brought in by road and rail. There was also the steep increase in water-testing and soil-testing. In one Region alone, over 1,200 such tests were done with the decentralized equipment.

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* The net figure, in each case, represents the officially-accepted stock-total at 1st January, 1966.

More than 213,000 bales of hay, and other fodder amounting to over 5,000 tons, were distributed—to about 3,400 farmers—in the Mid Coast and Hunter Region. The total of gift-fodder distributed in drought areas exceeded 10,000 tons.

In most districts many irrigation plants were installed or expanded to produce fodder for stock. These projects greatly increased the calls on extension officers for technical advice and guidance.

WATER DEPLETION IN THE MAIN STORAGES

The serious depletion of water for irrigation is indicated by the following figures, showing the quantities of water in the main storages as at 30th June, 1966, and the respective percentage of storage-capacity.

Storage	River	Quantity Stored (acre-feet)	Per cent of Capacity
Burrendong	Macquarie	32,870	0·6
Keepit	Namoi	17,260	3·5
Wyangala	Lachlan	47,470	15·4
Lake Cargelligo	Lachlan	11,290	25·9
Lake Brewster	Lachlan	100	0
Glenbawn	Hunter	34,350	12·9
Burrinjuck	Murrumbidgee	258,220	30·5
Menindee Lakes	Darling	303,970	19·9
Hume	Murray	834,080	33·1

The drought and depletion of water in main storage dams stimulated search for underground supplies and greater exploitation of natural surface flows. Illustrating this effect of the drought is the big increase (some 10,000 acres) in area of land under irrigation in the Gunnedah Region—mainly from underground sources.

STANDING COMMITTEE ON DROUGHT RELIEF

The Government had created in the preceding fiscal year a Cabinet Committee on Drought Relief, and following this a Standing Committee on Drought Relief was appointed. The Department's Chief of Regional Extension Services is Chairman of the latter.

The Standing Committee on Drought Relief has met regularly, reported direct to the Minister for Agriculture on matters referred to it, and also made recommendations for relief and allied schemes. The following major relief schemes submitted by the Standing Committee are in operation:

Advances for drought relief, by which $6,000 at 3 per cent interest repayable over a period of seven years is loaned to primary producers in necessitous circumstances, for "carry-on" purposes. So far, over 2,000 farmers have taken loans totalling $8 million.

A restocking scheme, with a maximum advance of $10,000 at 3 per cent interest and repayable over seven years, to purchase replacement stock.

Road-transport subsidy schemes to enable hay to be brought from Victoria, and for transport of all types of fodder to graziers in the Western Division.

Increased rail rebates on fodder, from 25 per cent to 75 per cent and more liberal conditions.

Rail-transport of wheat from southern parts of the State to the northwest at little or no cost to the farmer. Over 1½ million bushels of wheat were moved a distance of nearly 500 miles.

Subsidized rail-transport of water for stock.

A scheme to guarantee payments for wheat by farmers without ready finance.

STATE GOVERNOR VISITED DROUGHT AREAS

His Excellency the Governor of New South Wales, Sir Roden Cutler, visited the Western Division in March to survey personally the drought position. The trip was organized by the Chairman of the Standing Committee on Drought Relief. The party comprised His Excellency, the A.D.C., the Department's Chief of Regional Extension Services, and two journalists. Some 2,000 miles were travelled by plane and fourteen properties were visited.

PARLIAMENTARY SELECT COMMITTEE UPON DROUGHT RELIEF

With a view to inquiry into means of mitigating future droughts Parliament established a Select Committee Upon Drought Relief.

This Committee took evidence from many farmers' organizations, representatives of Government Departments, and private citizens. The Committee visited a number of drought areas—Maitland, Armidale, Dubbo, Bourke, and other centres in the Western Division—for on-the-spot discussions and to view the extremities of the drought. The Department's Chief of Regional Extension Services, Chairman of the Standing Committee on Drought Relief, gave introductory evidence to the parliamentary committee and accompanied it on all country visits.

Fodder Position

Continuation of the severe drought over most of the State from 1964 meant that at the start of the 1965–66 fiscal year there was little or no conserved fodder in New South Wales. Stocks from previous years had been used. As a result, stockowners attempted in various ways to overcome the problem of little paddock-feed and no reserves.

In coastal areas, and some favoured locations, maize crops were grown. Most of this grain was stored on the farm, hammermilled later and fed to dairy cows. Farmers who did this sustained production fairly well, and those who could supplement with hay actually increased milk and butterfat production. This may lead to expanded farm-production and utilization of maize. In general, the prices offered for maize grain were under $1.50 a bushel, as wheat was readily available at about this figure.

In the 1965 summer, Sudax hybrid-sorghum was tried by many farmers, in a wide variety of soil and climatic conditions, and most were well pleased by its yield. They found it an excellent grazing crop and, where a hay conditioner was used, it made into good hay. Where no conditioner was used the stems were a little too thick to allow it to cure before the leaf shattered. A few cases of suspected HCN poisoning were recorded.

Oats were planted as a grazing crop to help stock through the winter and spring. Increase in use of nitrogen for this crop was notable. The seeding rate where nitrogen was used was 3–4 bushels, and the nitrogen rate about 80 lb per acre. Irrigation with oats and nitrogen and irrigated Sudax may well be the basis of much of the fodder produced on the small and more intensely used farms in future—especially in coastal areas—as outcome of farmer experience in this drought.

Many farmers have gained a hard and expensive lesson in drought-feeding and supplementary-feeding. Because reserves on the farm were exhausted, and agistment hard to find and expensive, a decision had to be made as to whether stock should be allowed to die, sold for what they would bring, or hand-fed. Most farmers disposed of many head of stock and are hand-feeding breeding-groups.

It was thought that as stocks of hay, maize, sorghum, and oat grain became scarce their price would be extremely high. This has happened in the case of good lucerne hay, where paddock prices went to $90–$100 a ton. The general price has, however, ranged between $40–$60 a ton. Maize prices varied a little from district to district, but ranged around $1.40—1.70 a bushel; grain sorghum ranged $45—$60 a ton; oats ranged $1.10–$1.30 a bushel; and wheat $1.40–$1.50.

After experience of feeding wheat to stock, farmers appear to have accepted this grain as a standard. Thus its price largely controlled the price of other feeds, except in special circumstances and a few areas. The aforementioned prices each give a similar feed-unit price, except for hay. Hay at the cheapest rate was at least twice the price per feed-unit of wheat, sorghum, and maize.

The readily available wheat at a stabilized price has, to some extent, kept down the cost of the drought to stockowners.

Experiences in this drought have revealed to many stockowners deficiencies in management. And most would realize that they had no plan to handle such a situation as has occurred. Reports from many areas indicate that in the near future more efforts will be made to provide at least short-term reserves. More grain and hay seem likely to be stored.

The gift of fodder from Victoria, transported free by New South Wales railways, was a noteworthy gesture of goodwill and generosity to New South Wales stockowners. The total tonnage, though it could not greatly relieve the total position, enabled many badly-hit farmers to carry on at a critical stage and was a morale builder.

Effects of the drought will be felt by most sections of the community for a long time. It will be several years before stockowners replace all stock losses, and because of loss of capital and income there may be no immediate great expansion by way of hay sheds, silos, and other items of capital nature. There could well be expansion in cultivation of many of the grain, hay, and fodder crops, their value as a reserve having been demonstrated.

There has been notable lack of interest in silage, probably due to the thought that silage is too hard to take out of pits, stacks, clamps, but there are several systems of self-feeding silage that would overcome this.

Cloud-Seeding

Cloud-seeding is one of a number of measures taken to try to combat drought. For the past ten years the Department has been associated with the CSIRO Division of Radiophysics, in the conduct of cloud-seeding experiments. Results were sufficiently encouraging for the CSIRO Radiophysics Chief to recommend their application on a commercial scale, and New South Wales is the first State to engage in this.

As a drought relief measure, the seeding commenced in May, 1965. A plane was based at Wagga and operated mainly from there until 11th November, 1965. Early in December, 1965, the base was changed to Dubbo, and from there the seeding operations concentrated in an area north of the railway line extending from Bathurst to Broken Hill. At that time the northwest slopes and tablelands were excluded from the operation, because the CSIRO seeding experiments were continuing there. In May, 1966, those experiments were suspended and the plane switched to *ad hoc* cloud-seeding.

By May, 1966, three planes were operating. Their fields of operation were co-ordinated by the Department. One plane was under charter to the Department, one under charter to Cobar mining interests, and the other was the CSIRO plane, operating from Tamworth.

Agronomist Mr G. T. Campbell underwent training as cloud-seeding officer, and is now fully qualified and experienced in this work.

Assessment of the results of *ad hoc* cloud-seeding is difficult. But it is notable that in this year of drought many centres in the southwest slopes and the tablelands received about 90 per cent of average rainfall during the period of cloud-seeding operations and that this was in marked contrast to the remainder of the State.

For the summer period, cloud systems include cumulus formations. With these, visual assessment of the success of seeding is possible. From a scientific standpoint, visual evaluation is unacceptable. Nevertheless, observations left it possible that seeding made a worthwhile contribution. The value of increased rainfall, if this were the agent of increase, offset by far the cost of operating the planes.

Public acceptance has been encouraging. Demands for more information and for expansion of the service show no sign of slackening.

The following statistics of activities are recorded for posterity: In the 12 months to 30th June, 1966, the total of days of flying was 176, the total of days when seedings were made was 92, the total flying-time was 547 hours, the total seeding-time was 213½ hours.

Bush Fire and Flood Relief Committees

Following the disastrous bushfires in the southern tablelands in March, 1965, many hundreds of claims for relief were dealt with by the N.S.W. Bush Fire Relief Committee. In the past twelve months, the Committee held seven meetings.

The Chief of Regional Extension Services represents Agriculture in this Committee and in the N.S.W. Flood Relief Committee.

Fertilizers

Fertilizer manufacture, with emphasis on production of nitrogenous fertilizers is big news.

A number of powerful Australian, British, and foreign companies are conducting exhaustive inquiries into the possible demand for fertilizers on the Australian market.

Superphosphate and other forms of phosphatic fertilizers have, over the years, been pre-eminent, and will continue to be so in the foreseeable future. But interest in use of nitrogenous fertilizers, stimulated by intensive publicity, has definitely trended upwards.

A side-effect of the drought has been the difficulty of securing data about the economic usage of nitrogen for crop and pasture production. Even so, anhydrous-ammonia usage increased this year, from 334 tons (nitrogen) to 1,733 tons; a 419 per cent increase. Aqua-ammonia usage increased from 380 tons (Aqua) to 524 tons; a 38 per cent increase. Use of sulphate of ammonia and of urea also increased.

Demand for potash fertilizers is growing but as yet the consumption is relatively low.

High-analyses mixed-fertilizers are gaining in popularity. Despite most unfavourable seasonal conditions, distribution increased from 18,648 tons to 31,002 tons; a 66 per cent increase.

But for the drought, use of phosphatic fertilizers for 1964–65 would have topped the one million ton mark. In any case usage exceeded 900,000 tons. For 1965–66, the total has been about the same. Because of the drought it fell short of expectations for this year, by about 20 per cent.

Of the supplies from New South Wales sources (781,450 tons), the bulk-handled quantity was 485,794 tons (62.2 per cent).

Australian Agricultural Council and Standing Committee on Agriculture

The Australian Agricultural Council and Standing Committee on Agriculture each held two meetings; one in Adelaide in July, 1965, and the other in Sydney in February, 1966. Many items important to the agricultural industries were dealt with.

Royal Botanic Gardens and Government Domain Trust

The Royal Botanic Gardens and Government Domain Trust met twice. The Hon. W. A. Chaffey, Minister for Agriculture, and Mr R. M. Watts, Director-General of Agriculture became trustees. Dr Grahame Edgar on his retirement from the position of Director-General of Agriculture in May, 1966, withdrew from the Trust.

Matters considered included: the plan for re-modelling of the Domain Baths; approval for the construction of the Sir Leslie Morshead Memorial Fountain; kiosk leases in the Botanic Gardens and Government Domain areas affected by extensions to the Art Gallery of New South Wales; and additions to the Public Library; approval for construction of a substation in connection with the Naval Fuel Oil Tank installations.

Centennial Park Supervisory Committee

For the second consecutive year the Government provided, for supervision by this Committee, $60,000 for restorative and developmental expenditures in Centennial and Queen's Parks. Some detail of the ways the resultant works are proceeding is presented later in this Report (in the "Centennial Park; Queen's Park" sections, of the Botany Branch report, page 101).

Prior to each meeting, now held at the National Herbarium in the Royal Botanic Gardens, the Supervisory Committee members inspected the Parks to sight work in progress and consider other components of the desired development.

Farrer Memorial Trust

Three ordinary meetings and an annual meeting of the Farrer Memorial Trust were held. Dr Grahame Edgar, Director-General of Agriculture and Professor J. R. A. McMillan, Dean of the Faculty of Agriculture, University of Sydney, retired as official trustees and were replaced by Dr F. C. Butler, Deputy Director-General of Agriculture and Professor I. A. Watson, Dean of the Faculty of Agriculture, University of Sydney.

Professor J. R. A. McMillan was recipient of the 1965 Farrer Memorial Medal and delivered the Farrer Memorial Oration at a meeting of ANZAAS in Hobart in August, 1965. His oration was on "Water in Relation to Agricultural Production".

The 1966 Farrer Memorial Research Scholarship was awarded to Mr L. A. Douglas of Vudal Agricultural College,

Dr Grahame Edgar, O.B.E., D.V.Sc., A.R.C.V.S., Director-General of Agriculture, retired

Director-General of Agriculture 1961–1966, Dr Edgar retired in May after 40 years of service through the New South Wales Department of Agriculture. Some account of his long and distinguished career is presented in associated paragraphs.

Kerevat, New Guinea. Mr Douglas will depart for the United States of America in August for studies at Iowa State University on the nitrogen uptake of the wheat plant.

The 1966 Farrer Memorial Medal was awarded to Dr Grahame Edgar. Dr Edgar delivered the Memorial Oration in the Great Hall at University of Sydney on 23rd June. The Oration was "Australian Agriculture in the Post-War Era".

Retirement of Dr Grahame Edgar, Director-General

Dr Grahame Edgar, D.V.Sc., A.R.C.V.S., Director-General of Agriculture since 1961, retired in May, 1966. Dr Edgar's career of service with the Department of Agriculture extended over 40 years.

He joined the Department in 1926 as a junior veterinary officer, was stationed for short periods at head office, and Tamworth and Albury, but commenced in 1927 a period of 32 years at the Veterinary Research Station, Glenfield. He made significant contributions to knowledge of black disease in sheep, blackleg in cattle, infectious ophthalmia of sheep, toxaemic jaundice of sheep, amongst other conditions of sheep and cattle. Some 72 published papers on diseases of cattle, sheep, and swine were product of research in which he engaged.

In 1936 he was appointed Senior Veterinary Officer and, in 1947, Director of Veterinary Research. In 1959 he became Assistant Under Secretary to the Department and, in 1961, Director-General.

The degree of Doctor of Veterinary Science was conferred on him in 1962 by the University of Sydney. In 1963 he led the Australian Delegation at the 17th World Veterinary Congress in Hanover, Germany, and was Australian delegate also at the World Animal Production Conference, Rome. Amongst other special assignments accepted by Dr Edgar from time to time was one in Burma for FAO in 1952.

Amongst honours awarded during his long career with the Department was that of honorary associateship of The Royal College of Veterinary Surgeons, London, a distinction shared by only 43 people throughout the world. Another honour was the award of the Farrer Memorial Medal, 1966. Shortly after retirement, Dr Edgar was honoured with an O.B.E. in the Queen's Birthday Honours List, June, 1966.

New Director-General and other Senior Appointments

Mr R. M. Watts, Deputy Director-General since April, 1965, and former Chief of the Division of Animal Industry, was appointed Director-General on the retirement of Dr Grahame Edgar in May, 1966.

Dr F. C. Butler, Principal of Wagga Agricultural College since 1962, former plant pathologist and Senior Research Officer at the Agricultural Research Institute, Wagga, was appointed to the Deputy Director-General position vacated by Mr R. M. Watts.

Mr B. F. Atkins, Deputy-Principal of Hawkesbury Agricultural College, and former science lecturer at Wagga Agricultural College, was appointed Principal of Wagga Agricultural College in succession to Dr F. C. Butler.

Mr W. J. C. Hudson, Supervisor of North Coast Dairy Industry Research, and former research agronomist and District agronomist, was appointed Deputy-Principal of Hawkesbury Agricultural College in succession to Mr B. F. Atkins.

Finance—Summary

Consolidated Revenue Fund Expenditure and Receipts.—Expenditure from Consolidated Revenue Fund in 1965–66 was $12,637,496. This included $2,104,058 for Cattle Tick Control on the north coast and $444,962 for the upkeep of the Royal Botanic Gardens and Admiralty House; in part recouped from the Commonwealth Government.

Further details, in support of the Consolidated Revenue Fund expenditure by other Government Departments on behalf of the Department of Agriculture, are shown in the Public Accounts tabled in Parliament each year as an accompaniment to the Report of the Auditor-General.

Receipts from all sources totalled $5,208,177, and are shown in some detail later in this report. (*Appendix I*—The Accounts of the Department of Agriculture, 1965–66.)

Capital Works.—Capital works to the value of $285,088 were constructed and a Loan programme of $320,000 has been prepared for 1966–67. Details of the Loan works expenditure are shown in *Appendix I*—The Accounts of the Department of Agriculture, 1965–66.

Trust Funds.—The provision of funds by industries, semi-government bodies, Commonwealth Government grants and specialized taxations continues to show the upward trends of recent years. Substantial sections of the research programmes have been financed by these means and findings have been extended to the primary producers and others with the help of special Commonwealth grants (*vide* "Commonwealth Extension Services Grant" and "Commonwealth Dairy Industry Extension Grant").

Expenditure from such grants or trusts is handled through the "Special Deposits Accounts" at the Treasury and regulated either by Act of Parliament or by such directions as may be given by the donor body, to whom the Department of Agriculture must account at the close of each financial year.

Some of the more important aspects of the operations on the Special Deposits Accounts are given in *Appendix I*—The Accounts of the Department of Agriculture.

Commonwealth Grants for Extension Services

AGRICULTURAL EXTENSION SERVICES GRANT

This Grant was continued for a further twelve months to 30th June, 1966, pending clarification of the proposed expansion in 1966–67. New South Wales received its normal $150,000 for the year. The total received by the State from this Grant since inception in 1952 is now $1,841,755. This has been spent as follows: Employment of field assistants and provision of transport ($617,460); employment of regional publicity officers, and extension publicity activities ($355,071); pasture and crop demonstration projects ($195,190); support of agricultural trainees at Universities and Colleges ($171,079); provision of extension equipment ($116,668); agricultural machinery ($103,486); books and publications for extension ($71,577); livestock demonstration projects ($71,297); fruit-production demonstration projects ($47,791); employment of Italian liaison officer as an extension aid ($31,251); study tours ($24,833); and in miscellaneous ways ($36,052); total $1,841,755.

DAIRY INDUSTRY EXTENSION GRANT

Since inception of this Grant in 1948, this Department's expenditures from the funds allocated have amounted to about $2,000,000. The objectives have been to raise the efficiency of dairy farming. The objective continued to be pursued with the funds expended in the past financial year.

The main projects continued to be as follow: Grade-Herd Recording; field assistants for extension officers; extension publicity; survey of efficiency of milking machines; sire-survey in relation to artificial breeding; a testing station for air-flow meters and regulation; farm demonstrations; punch-card equipment for Grade-Herd Recording; and agricultural trainees at universities and colleges. Also, this year the funds provided for the Department's Librarian-in-charge to attend the Third World Congress of Agricultural Librarians and Documentalists, in Washington D.C.

Industry Funds for Research

GENERAL

The Department received approximately $545,000 this year from the various industry levy funds in support of research-expansion.

The former "Australian Cattle and Beef Research Committee" has become the "Australian Meat Research Committee". This was because of the decision to levy mutton and lamb slaughterings, to provide funds for meat research. As a preliminary to submitting lamb and mutton research projects the Division of Animal Industry has summarized for presentation to the Australian Meat Research Committee the current sheep research work related to meat.

Intra-Departmental Committees.—These committees to consider details of research projects submitted for industry funds were discontinued during 1965–66. They are to meet again in 1966–67, to consider projects submitted to the Wheat Research Committee of New South Wales, Wheat Research Council, Wheat Stabilization Fund authority, Australian Meat Research Committee, Wool Research Trust, and Australian Dairy Produce Board.

The Funds for Specific Projects.—The following are details of funds provided for specific research projects during 1965–66, except that in the case of the Wheat Stabilization funds the figures represent "progress" amounts as known up to 30th June, 1966.

WHEAT INDUSTRY RESEARCH COMMITTEE FUNDS

Wagga Agricultural Research Institute Projects.—Agronomic survey unit ($15,200); skeleton weed ($1,600); breeding of improved varieties for irrigation ($4,800); improved pastures and soil fertility ($2,500); genetic analysis of maturity ($3,600); growth development and yield ($4,000), in association with Tamworth Station; machinability of doughs ($1,200).

Tamworth Agricultural Research Station Projects.—Controlled environment—frost resistance ($10,000); legumes' relation to soil productivity ($7,400); frost research—overseas visit by Dr W. V. Single ($2,000).

Condobolin Agricultural Research Station Projects.—Variety testing and plant nutrition ($20,000); residual fertilizers—effect on pasture ($6,100).

Cowra Agricultural Research Station Project.—Plant nutrition ($4,660).

Graman District Project.—Black Soil Scarab ($1,100).

Chief Research Liaison Officer, Overseas Project.—Congress in Sweden, attended by Dr S. L. Macindoe ($600).

WHEAT INDUSTRY RESEARCH COUNCIL FUNDS

Tamworth Agricultural Research Station Projects.—Photoperiod and temperature studies ($7,376); improvement of Durum wheat varieties ($6,800); World Wheat Collection, overseas travel by Mr E. M. Matheson ($1,000); frost resistance ($2,130); hybrid wheat ($3,246); frost injury, overseas study by Dr W. V. Single ($2,000).

Wagga Agricultural Research Institute Projects.—Baking quality ($7,400); visit to Afghanistan by Mr G. M. Halloran ($2,000).

Division of Science Services, Rydalmere, Project.—Yellow Dwarf Virus ($300).

Marketing and Agricultural Economics Division Project.—Economics of segregation and storage of wheat ($5,000).

WHEAT INDUSTRY STABILIZATION (DISPOSAL) FUND—PROGRESS AMOUNTS

Wagga Agricultural Research Institute Projects.—Accuracy and usefulness of soil phosphate tests for yield production of wheat ($33,400); environmental control cabinets ($8,000); drought resistance in wheat varieties ($14,000); visit to Afghanistan by Mr G. M. Halloran ($500).

Tamworth Agricultural Research Station Projects.—Mobile equipment for nutrition and plant breeding work ($14,000); weed control in northern wheat belt ($24,176); cereal chemistry research unit ($27,884).

Sydney University Project.—Controlled environment equipment for Castle Hill Research Station ($20,000).

Cowra Agricultural Research Station Project.—Wheat research in the central west ($16,550).

WOOL RESEARCH TRUST FUNDS

Wagga Agricultural Research Station Project.—Effect of pasture management and time of lambing on wool and lamb production in the southwestern wheatbelt of N.S.W. ($400).

Division of Science Services, Rydalmere, Project.—Insecticide resistance in sheep blowflies ($3,500).

Trangie Agricultural Research Station Projects.—Efficiency of wool production ($4,800); fleece measurement for selection of stud Merino rams ($14,000); comparison of two management systems ($3,500); investigations of vital statistics of Yass Valley Merino flocks ($6,800).

Graman District Project.—Black Soil Scarab ($2,600).

Bathurst Agricultural Research Station Project.—Serrated tussock control ($2,000); aerial control of serrated tussock, southern tablelands ($3,000).

Shannon Vale Project.—Sheepbreeding and pasture management—relative efficiency at several stocking rates and superphosphate levels ($6,000).

Goulburn Project.—Adaptive pasture research, southern tablelands ($10,800).

Temora Agricultural Research Station Project.—Influence of rates of stocking and superphosphate applications on the productivity of Merino ewes grazing improved pastures ($1,000).

Wollongbar Agricultural Research Station Project.—Overseas travel of Mr J. M. Holder ($1,300).

AUSTRALIAN MEAT RESEARCH COMMITTEE FUNDS

Grafton Agricultural Research Station Projects.—Upper River beef feed-year research ($22,940); determination of available phosphate levels ($14,940); sod-seeder development ($4,000).

Tamworth Agricultural Research Station Project.—Diagnosing element-deficiencies in soils ($3,780).

Leeton Agricultural Research Station Project.—Pasture intake and digestibility studies ($8,864).

Glen Innes Agricultural Research Station Project.—Winter nutrition—northern tablelands ($11,820).

Division of Marketing and Agricultural Economics Project.—Nature and organization of the beef cattle industry ($5,800).

Trangie Agricultural Research Station Project.—Beef cattle breeding improvement ($8,500).

Division of Science Services, Rydalmere, Project.—Inoculum for summer legumes ($5,700).

Glenfield Veterinary Research Station Projects.—Incidence, importance and control of parasites of cattle in N.S.W. ($3,540); epidemiology and control of fluke parasites of cattle in N.S.W. ($9,000).

AUSTRALIAN DAIRY PRODUCE BOARD FUNDS

Wollongbar Agricultural Research Station Projects.—Socio-economic investigations ($14,610); pasture species research ($12,276); other pasture and animal research ($20,262); flood irrigation research ($1,120).

Hawkesbury Agricultural College Projects.—Efficiency of detergents and sanitizers ($4,790); re-combining unit ($40,000); manufacturing and keeping qualities of processed cheese ($2,320); influence of seasonal variations of skim milk on physical and chemical qualities of spray—dried skim milk powder ($7,680).

Biology Branch, Division of Science Services Project.—Bacteriophage-antibiotic interactions ($720).

BANANA RESEARCH ADVISORY COMMITTEE FUNDS

Alstonville Tropical Fruit Research Station Projects.—Mixed-ripe problem ($200); packaging ($120); handling ($100); ripening ($1,296); pre-cooling ($710); staff and travelling ($4,550).

TOBACCO INDUSTRY TRUST ACCOUNT FUNDS

An allocation for research and extension.—$29,050.

SUMMARIZED TOTALS

The following were the total allocations and the expenditure for research from the various Industry Funds in 1965–66, with 1964–65 relationships as shown:

	1964–65		1965–66
	Allocated	Expended	Allocated
	$	$	$
Wheat Industry Research Committee	65,800	73,418 (incl. carryover)	84,760
Wheat Industry Research Council	26,076	26,170	37,252
Wheat Industry Stabilization Funds	115,460 (incl. unexpended bal. from 1963–64)	50,075	102,130 (incl. unexpended bal. from 1964–65)
Wool Industry Research Committee	77,880	63,780	59,700
Meat Research Committee	103,844	50,154	98,884
Australian Dairy Produce Board	62,224	68,324	103,778
Tobacco Industry Trust Account	84,120 (plus $81,382 set aside for Ashford Tob. Res. Station)	14,138	58,100
Totals	535,404	346,059	544,604

Industry Fund allocations have continued satisfactorily during 1965–66 but one effect of the drought will be restriction of industry research funds for 1966–67. Examples of this effect are already available: in the case of the Wheat Industry Research Committee, three appointments previously approved have been withdrawn because of a shortage of funds; in the case of the Meat Research Committee, two such appointments not actually fulfilled are also being withdrawn for 1966–67.

Research Liaison Office

SCOPE

The Chief Research Liaison Officer has a responsibility to influence the standard of research work of the Department. He pursued this by stimulation and co-ordination of research programmes and, where desirable, standardization of procedures. In the first half of this Report year Mr L. Kavanagh, Principal Agronomist (Research), Division of Plant Industry, occupied the position of Chief Research Liaison Officer on a part-time basis until the duties were resumed by Dr S. L. Macindoe on the latter's return from overseas.

The Chief Research Liaison Officer is responsible also for liaison with and co-ordination of data and reports for submission to the various industry research committees from which considerable funds are secured for Departmental research projects (see on page 13, the heading "Industry Funds for Research").

Also the Automatic Data Processing officers of the Department are responsible to the Chief Research Liaison Officer.

SEMINAR AT UNIVERSITY OF NEW ENGLAND ON REGIONAL RESEARCH

A Seminar on Regional Research was conducted at the University of New England from 26th May to 1st June, 1966. This was attended by officers from most Departments of Agriculture, the CSIRO, the Universities, and the Commonwealth Department of Primary Industry, and representatives of some Industry Fund Committees.

A fact which emerged was the growing effectiveness and strength of regional research within N.S.W. The Department's institutions at Tamworth, Wollongbar, Trangie and especially Wagga were examples accepted as showing the excellence which can be achieved in regional research where sufficient resources of funds and trained staff are available to State Departments.

A general though not necessarily unanimous view was that regional research is primarily the responsibility of State Departments. Another general view was that, provided resources are made available and experienced staff are held by greater salary uniformity, integrated regional research programmes should be led by local departmental research leaders with considerable responsibility for defining, planning and supervision of research programmes. Such programmes would continue to require State and perhaps interstate co-ordination. More movement, especially of CSIRO personnel into State institutions, was suggested.

There were criticisms. These included criticism of the management of some regional institutions by officers without a background of research experience.

Perhaps the most important general viewpoint in the Seminar was that of State Departments' responsibility to solve the practical regional problems of farmers through the further development of regional research centres. This further development would depend on the ability of States to retain research leaders through equal salary opportunities and facilities. Implicit also was the need for States to receive increasing financial support which may have to come largely from Commonwealth Grants for research and extension and from Industry Research Funds.

RESEARCH REVIEW COMMITTEES

Late in 1964 each Chief of Division was requested to form a committee to review critically and report on the research work of each research officer. The research programmes of 126 officers have been so reviewed and reported on to the Director-General. This total is more than half that of all research personnel. Completion of all reviews is being pursued.

POST-GRADUATE TRAINING OF OFFICERS

The number of Departmental officers receiving post-graduate training has increased substantially. At 30th June, 1966, there were 10 officers doing post-graduate study overseas and nine others engaged in post-graduate study in Australia. Industry research funds made possible some of these cases.

RESEARCH LIAISON OFFICERS (SCIENCE PUBLICATIONS)

This position is within the Division of Information Services establishment. The effect of this officer's work on rate and quality of research publication has been considerable. It is reported under "Division of Information Services". (See page 113, heading "Research Liaison Service (Science Publication)".)

AUTOMATIC DATA PROCESSING SECTION

The A.D.P. System for Herd Recording was further developed to include the printing of additional reports and the matching of "entry", "sub-period" and "exit" data without use of external sorting and collating equipment.

Procedures for collection and preparation of data in respect of Official Section Cows' records were revised. The product of this revision will reduce the amount of clerical work performed by the farmer, the herd recorder, the clerical staff of the Division of Dairying and the punch-card operators. The scope for error has thus been reduced. And despite the increasing volume of data to be processed (see the following tabulation) it is thought that existing staff can cope with the current work-volume.

Moreover, when other proposed new procedures are implemented, the tabulating, sorting and collating equipment in the Department's Punch Card Section will no longer be required.

Recording year	Cows completing a lactation	Estimated number of cards punched
1955–56	68,550	—
1956–57	61,176	524,000
1957–58	48,617	441,000
1958–59	53,596	487,000
1959–60	63,944	578,000
1960–61	65,911	598,000
1961–62	73,822	300,000 (*b*)
1962–63	76,682	204,000
1963–64	77,033	207,000
1964–65	94,688	248,000
1965–66	90,000 (*c*)	236,000

(*a*) Not punched for full year.
(*b*) Punching of "sub-period" (i.e., monthly production) cards for Group Section cows ceased.
(c) Estimated.

Sire Survey results produced for the Department were supplied also to the New South Wales Milk Board for use in artificial-breeding programmes.

For the first time, timely advice is now available to farmers as to the breeding worth of all dairy bulls whose daughters are in the Department's Herd Recording scheme. The information is basic to breeding-programmes aimed at increased milk and butterfat production.

Computer-processing of all herd-recording data has reduced the delay in producing reports and statistics for use of dairy farmers, and research and extension workers.

Some Notable Developments

CONCERNING LIVESTOCK

"Newcastle Disease" of Poultry.—This disease not hitherto known to be present in Australia was found in New South Wales and several other States. The infection was recognized first in Queensland, then testing of New South Wales flocks which had supplied birds to the infected Queensland farms revealed it here. A survey showed it to be widespread, particularly in Sydney and Tamworth areas, but fortunately the virus strain is extremely mild.

Swine Fever.—No outbreak was recorded, and the disease appears to have been eradicated. However, previously introduced regulations to control swine fever remained in force. These included compulsory boiling of all garbage prior to feeding to pigs, and total ban on sale of pigs in public saleyards except for immediate slaughter.

There is strong evidence that the regulations designed to prevent spread of swine fever, and in particular the ban on sale of store pigs, have significantly reduced incidence of other important pig diseases. Condemnations of pig carcasses have dropped from the 0.5 per cent level which prevailed before these restrictions applied, to 0.097 per cent in 1965–66.

Bovine Tuberculosis.—The programme of area eradication, initiated in 1960, was continued—although the drought prevented the anticipated increased testing. The total of cattle tested was 674,552. Of these, 1,277 reacted (0.19 per cent). This 0.19 per cent was a significant reduction on the previous year's infection level of 0.38 per cent. One more Area was gazetted this year. There are now seventy eradication Areas.

Cattle Tick Research.—Studies on migration of larvae of the cattle tick (*Boophilus microplus*) have shown that in favourable situations some of the larvae can move as far as 100 ft. Migration of tick larvae as unattached passengers on birds and mammals for distances in excess of 200 yards was also demonstrated. The tick-history of the Queensland border indicates that such movement must be rare, but it offers an explanation of many of the tick-fever outbreaks that have occurred.

Weight-gain Selection-procedures for Beef Breeders.—Among the projects developing selection procedures for maximized production in beef-breeder herds is that of weighing the animals, as well as grading them on conformation, at strategic periods—namely at weaning and the yearling stage. After the weights have been adjusted for age and sex, replacement bulls and heifers are selected in light of the information so gained.

In one herd, the procedure has enabled the weaning-weight of calves to be increased by an average of 15 lb over a three-year period. Bulls that gained 0.5 lb per day faster than their contemporaries sired progeny which were more than 30 lb heavier as yearlings than were the progency of slower-gaining bulls.

Trend from Dairy Production into Beef.—There is a rapid decline in the number of farmers in dairying on the far north coast.

Twenty-three per cent of the dairy farmers in the Kyogle area have been lost from the industry in the last seven years. Most of these farmers were previously on a marginal income However, apart from seasonal fluctuations there has been no corresponding decline in production. The change in numbers has been largely brought about by aggregation of small holdings, in themselves inefficient but capable of more economic production under larger-area management. Some have been incorporated into larger dairy farms; others into beef cattle properties.

Beef breeding is the main cattle industry in the Kyogle district, with fattening on the better pastures surrounding the rivers and creeks. The main limitation is lack of high quality pasture. Winter and spring feed shortages prevent quick-maturing of beef cattle and reduce the stocking rates in winter and spring. Development of subtropical pastures will improve the beef quality and stock-carrying capacity.

Concerning Murwillumbah district: in Tweed Shire 260 dairy farmers have gone out of production since 1950—when 787 dairy farmers were registered. But district butter-production has not declined comparably. This indicates that the farmers remaining in dairying are more efficient than those who have left it. Analyses indicate that 20 of these 260 properties have gone out of production, 113 have changed from dairying to grazing, 51 have taken up banana-growing and grazing, 21 have gone into small-crops, 47 have changed to cane-growing and grazing, and eight have been subdivided. Yet, sales of seed and fertilizer to dairy farmers continue to show an increase each year and are now greater than they were 15 years ago when there were 13 per cent more dairy farmers in the Murwillumbah area.

There have been marked increases in acreage sown to oats and in use of nitrogen. It is apparent that farmers remaining in dairying are increasingly conscious of the need to improve production and are doing something about it.

The Murwillumbah area reveals a marked increase in beef cattle numbers in the past two years. Vealer-raising is the main form of beef production there. New landholders are showing the way, by utilizing improved pastures.

The trends in the Kyogle and Murwillumbah districts towards beef production and away from dairying, demand care in allocations of industry-research and industry-support funds and measures.

Sheep Blowfly Tolerance to Organophosphorus Insecticides.—Late in 1965, sheep blowflies from the field were diagnosed as being less susceptible to organophosphorus chemicals than they had been for the previous eight years. This recent change in blowfly response to organophosphorus insecticides has been tentatively termed "tolerance", not resistance. Progress research indicates that these insecticides may still be used to combat flystrike, but with a slight decrease in the until-now expected period of protection.

Work is proceeding with an alternative group of chemicals, the carbamates.

CONCERNING PASTURES AND CROPS

Assessments of "Old" and "New" Pasture Species.—The seasonal conditions have provided for a critical re-assessment of pasture species.

Phalaris tuberosa has persisted through difficult times, and given some excellent production, but there has been some associated phalaris-toxicity—accentuated, under drought conditions, by the utilization of any available "green pick".

Cocksfoots have been relatively disappointing under high grazing-stress, and in part because of heavy scarab-grub infestations in tableland districts.

Kangaroo Valley ryegrass continued to perform well, showing persistence and drought- and heat-tolerance in both dryland and irrigation conditions.

Lucerne has regained status as "King of Fodders", after receiving less than its due in recent years as a pasture-component and as a hay-source. Lucerne-research emphasis has been on rotational grazing management, new winter-growing varieties, breeding of "creeping" varieties, and aspects of plant nutrition. The Hunter River variety continues to be generally accepted. It is widely-adaptable for dryland grazing and for irrigation use.

In the temperate-legume range, "Marramar" Subterranean clover and Cyprus and Barrel Medic 173 have given good results. *Lotus* species are gaining popularity in coastal river districts.

Kikuyu grass has received prominence as a dairy (and beef) feed-source under heavy nitrogen-treatment in coastal districts. Promising new cultivars from Kenya promise better drymatter-production, nutrition value and "true-seed" production.

Setaria anceps continues to be one of the most promising of the introduced summer-growing grasses for coastal districts.

The subtropical legumes, including "Siratro", *Glycine* ("Clarence" and "Tinaroo"), *Desmodium* ("Greenleaf" and "Silverleaf") and *Dolichos lab lab* showed continued acceptance in spite of drought, high seed costs, insect pests, and establishment difficulties. Acreage for production of tropical-pasture seed increased fourfold in 1965–66, compared with the previous year.

Increased Status of Annual Summer-growing and Winter-growing Forage Crops.—In the drought conditions the deficiencies of native and sown pastures have been all too obvious. Hence there has been rapid increase in use of annual summer and winter forage-crops on cultivated land to meet immediate feed problems.

Cowpeas and *Dolichos lab lab* have been used successfully in coastal districts Sudax, Zulu and Trudan have been grown on large acreages in both dryland and irrigated conditions. Great interest in Sudax-type hybrid forage-sorghums has been generated, together with some management problems.

The drought conditions have prompted extensive use of grazing oats, sown at heavy rates and with heavy application of nitrogen fertilizer, for autumn and winter feed in tableland, slopes and coastal districts. Similarly, turnips, rape and chou mollier have been used on the tablelands.

The "Feed-Year" Approach to Planned Pasture Production.—The planned "feed-year" approach to pasture production has been stressed in extension, with weight on use of lucerne, winter pastures, summer pastures and winter and summer forage-crops. Grain feeding and use of nitrogen-fertilized forage-crops, under irrigation, have been prominent in meeting "feed-year" requirements in the drought situation. The value of hammermilled cob-maize as a dairy supplement has been emphasized.

The "feed-year" concept developed by research over 15 years at Wollongbar Agricultural Research Station is now being tested on a "whole-farm" basis on seven representative properties on the far north coast, including some in a "rapid-development" programme. Each of these "research farm projects" is proceeding very satisfactorily—with special interest apparent in bank personnel.

Rice, New Varieties of World Importance.—A major advance in world rice-breeding has been achieved by the Department's programme, with release of two new varieties—YRL 1 and YRL 2. These combine long-grain shape with exceptionally high yields; yields previously regarded as impossible for a long-grained variety. Their performance was even more noteworthy by virtue of outyielding the established short-grained varieties which for many years have produced the highest yields throughout the world.

Changes in consumer-tastes in the past decade had prompted the industry and the Department to strive to develop a high-yielding long-grained variety. As an interim measure, the low-yielding Bluebonnet 50 was released, whilst the breeding-programme was intensified to combine high yield with a long and fine-shaped grain even though they had so far defeated rice breeders throughout the world.

The two outstanding lines YRL 1 and YRL 2 are closely related selections from Bluebonnet 50 x Calrose. At Yanco Agricultural College and Research Station they yielded 4.67 and 4.56 tons per acre, compared with 4.39 and 4.26 tons for Calrose and Caloro II; whilst Bluebonnet 50 produced only 3.24 tons per acre—the highest yield ever recorded for this variety.

Record Acreage and Per Acre Yield.—Two new records were established by the New South Wales rice industry this year. For the fifth successive season a new, total-production record was created. The crop yield is estimated at 180,000. The previous record was 150,000 tons, in 1964–65. More significant was the new, world-record yield average—2.78 tons per acre. The previous record was 2.64 tons per acre, of seven years ago.

The 2.78 tons per acre for the New South Wales crop is particularly impressive when note is taken of the fact that the outstandingly efficient rice-growing countries Spain and Italy achieved slightly less than 2 tons per acre.

The high efficiency of rice production in New South Wales stems in part from the research and extension programmes conducted by this Department and in part from the readiness of the industry to adopt rapidly the latest in research findings. The achievements in rice research have been due in no small measure to the excellent co-operation between rice-industry organizations and the Department over many years, and funds contributed by the organizations.

Cotton's Continued Rapid Expansion.—The cotton industry of New South Wales and in particular the Namoi (Wee Waa-Narrabri) area has emerged as an important primary industry over the past three years. In 1965–66 some new records were established by it. Foremost amongst these was production of some 70,000 bales of raw cotton from a planted area of 31,600 acres. The production comprised three-quarters of the Australian cotton crop for 1965–66 and more than half of the present, annual raw-cotton requirements of the Australian textile industry. The value of the raw cotton produced was $13 million, and the associated 31,000 tons of fuzzy cotton seed was worth about $1.36 million.

Cotton ginning capacity was increased in the Namoi Area to almost three times that available in the 1964–65 season. Thus the crop could be processed without prolonged delays such as were experienced in the preceding season.

Plantings in the Namoi area were estimated at 30,000 acres, with a yield average of 2¼ bales per acre. The best crops produced more than 3 bales per acre.

In southern irrigation areas, 2,124 acres produced a yield average of slightly more than ¾ bale per acre. The best crops produced around 1¾ bales per acre.

Griffith District agronomist Mr D. E. Wallin visited the U.S.A. for eleven months this year, sponsored and partially financed by commercial organizations. His visit was concerned mainly with cotton production methods in the high plains region of Texas. This is a short-season area, climatically similar to southwestern New South Wales.

The Plant Nutrition Section of the Chemistry Branch has completed the first stage of a programme designed to study nitrate-levels in cotton petioles, to relate them to yields of cotton and develop standards for local conditions. This is towards development of a system on which to make fertilizer-recommendations.

Zinc Deficiency in Maize.—Northwestern District agronomists in collaboration with Plant Nutrition Section of the Chemistry Branch achieved spectacular results in correction of zinc deficiency in irrigated maize crops in the Quirindi to Moree area. Timely diagnosis and treatment helped to save most crops. Irrigation equipment and row-crop machinery worth $500,000 were involved in this first widespread growing of maize in the northwest.

Large-Scale Vegetable Production.—In recent years a large-scale grower of carrots in the Griffith district, a large-scale grower of lettuce at Hay, and several potato-growers throughout the State have set examples in mechanized vegetable-growing. This season there was a 230-acre crop of tomatoes on a Griffith farm, and excellent management resulted in a yield averaging about twice that of the district in general.

These ventures have already had a positive influence on attitudes towards large-scale mechanized-production of vegetables, and it is appropriately at a time when the supermarket type of selling is increasingly demanding bulk-lines of quality-produce.

Co-operation with CSIRO.—A development of significance is the increasing co-operation between the Division of Plant Industry of this Department and the CSIRO Division of Plant Industry, Canberra.

In the past year four of the Department's newly appointed agronomists were located with the CSIRO at Canberra, for a three-year period of training and co-operative research. These appointments were financed from Wool Research Funds.

Two of the plant breeders have spent the year at Canberra in an advanced plant-breeding training-course conducted by CSIRO.

Another example of the co-operation is the recent establishment of the Forage Introduction Research Committee to integrate the two organizations' research in this field.

CONCERNING PLANT INSECT-PESTS

Wingless Grasshopper; Aerial Spraying Campaign.—A big campaign against the wingless grasshopper was conducted on the northern tablelands in spring and early summer, after the pest was declared noxious. Technical malathion was applied from the air as an ultra low-volume treatment, of 8 oz weight per acre. More than 200,000 acres were treated. This was the first large-scale use of the method in Australia. Where weather and topography were reasonable the results were very satisfactory.

Fruit Fly; Whole-town Treatment Scheme.—Introduced by the Division of Horticulture this approach continued to gain momentum. Twenty-three country towns are now co-operating voluntarily. The outstanding results achieved in initial programmes have been maintained. Need for supervisory staff is the present limiting factor.

To overcome this problem and take full advantage of the "break-through" in fruit-fly control, Regulatory boundaries have been reviewed, new Inspectorates created, and application made for the allocation of special funds to further demonstrate that fruit fly can be efficiently and economically controlled by co-ordinated efforts. The Department of Local Government has shown considerable interest and sympathy with the scheme.

Orchard Pest Control; Co-operative Inter-Government Investigations.—A Technical Sub-Committee comprising representatives of the CSIRO Division of Entomology, and the Entomology establishments of the Victorian, New South Wales, Tasmanian, and South Australian Departments of Agriculture was formed. This is to plan and recommend a co-operative research programme, to explore development of an integrated pest-control programme for pome fruit orchards. The project, approved by the Australian Agricultural Council, is planned initially as a three-year study on orchards in Tasmania, Southern Victoria, South Australia, the Murrumbidgee Irrigation Area of New South Wales, and at Bathurst, and Canberra. It is financed by the Australian Apple and Pear Board and the Commonwealth. The venture represents a big step forward in State and Commonwealth co-operation in scientific investigations.

CONCERNING THE AGRICULTURAL COLLEGES

Entry Standards Higher.—The new, higher entry standards for Hawkesbury and Wagga Agricultural Colleges were applied to the 1966 intake of new students. For the Agriculture Diploma, at Hawkesbury and Wagga, and also for the Dairy Technology Diploma, at Hawkesbury, the minimum is now the 4th Year School Certificate or its equivalent—from secondary schooling—comprising passes in at least five subjects with two passes at the advanced level. And the five subjects must include English, Mathematics, and Science. For the Food Technology Diploma, at Hawkesbury, the present minimum is the Leaving Certificate—from secondary schooling.

In all three Diploma courses, entry-preference was given in 1966 to Leaving Certificate holders and in fact almost 100 per cent of the entrants had this qualification.

The higher entrance-standards have been accompanied by significant changes in the course-work, notably in the Agriculture Diploma courses—and further changes are pending. Meantime the Agricultural Colleges Advisory Committee is giving still further consideration to entry-standards and to course-objectives.

College Lecturers' Conference.—A most successful Conference of College Lecturers—the first of its kind—was conducted at Hawkesbury Agricultural College in February, 1966. Besides Hawkesbury Agricultural College staff, 16 lecturers from Wagga and 2 from Yanco Agricultural College attended, also representatives from the Queensland (Gatten) and South Australian (Roseworthy) Agricultural Colleges. Guest speakers from the University of New South Wales and the Department of Education participated.

Commonwealth Financial Aid.—Under the "States Grants (Science Laboratories and Technical Training) Act, 1964", totals of $365,000 for Hawkesbury and $440,000 for Wagga Agricultural College have been granted for building and equipment improvement programmes unfolding in the triennium 1965–68. Considerable development is proceeding at each of the Colleges, financed by these funds.

Seventy-fifth Anniversary of Hawkesbury.—A ceremony was held on 18th March, 1966, to celebrate the 75th Anniversary of Hawkesbury Agricultural College. The Minister for Agriculture unveiled a commemorative plaque.

The fund required for construction of a Gymnasium to mark this special occasion in the history of the College, is now at about the half-way mark, and Stage I (the main body of the Gymnasium) will be started during 1966.

Personnel and Staff Branch

New Salary Agreements.—Nineteen new Agreements affecting salaries of Departmental officers were received, and the necessary adjustments of salaries were made.

Salary Determinations.—The Public Service Board determined three new rates of pay in respect of certain Departmental officers and salary adjustments were made accordingly.

New Positions.—104 new positions were created, compared to 125 in 1964–65 and 164 in 1963–64. The details are as follows:

	New Positions Created	
	1964–65	1965–66
Professional Division	27	32
Clerical Division	13	16
General Division	85	56
	125	104

Total of Officers Employed.—The total of officers employed under the authority of the Public Service Board, as distinct from Ministerial employees (894), increased from 2,492 at 30th June, 1965, to 2,679 at 30th June, 1966.

Staff Numbers at 30th June, 1966

	Public Service Board	Ministerial	Totals	Casuals included in Ministerial
Central Administration*	682	8	690	..
Division of Science Service	162	1	163	1
Division of Plant Industry	208	..	208	..
Division of Horticulture	187	..	187	..
Division of Dairying	226	..	226	..
Hawkesbury Agricultural College	68	85	153	20
Wagga Agricultural College	39	49	88	1
Research Stations†	283	216	499	15
Division of Animal Industry—				
Head and District Offices ..	335	1	336	..
Queensland Border........	65	1	66	1
Tick Quarantine Areas	43	511	554	..
Meat Inspection Service ..	228	19	247	..
Royal Botanic Gardens	153	3	156	3
Totals	2,679	894	3,573	41

* Including Division of Marketing and Agricultural Economics and Division of Information Services.

† Including Yanco Agricultural College and Research Station.

STAFF CHANGES AND MOVEMENTS

Appointments/Promotions.—Mr R. M. Watts, Director-General; Mr B. F. Atkins, Principal, Wagga Agricultural College; Mr S. P. Hebden, Assistant Principal Veterinary Research Officer; Mr R. G. Kebby, Deputy Chief, Division of Horticulture; Dr F. C. Butler, Assistant to the Deputy Director-General and, later, Deputy Director-General (R.E.); Mr K. A. Russell, Accountant; Dr R. B. M. Dun, Director of Animal Production Research; Mr P. C. Druce, Deputy Chief, Division of Marketing and Agricultural Economics; Mr G. A. Crawford, Assistant Principal Agronomist (Extension); Mr E. Tindale, Regional Supervisor, Leeton; Mr D. McGregor, Pastures Protection Officer; Mr D. S. Leigh, Special Fruit Officer; Mr C. H. Mort, Special Fruit Officer; Mr A. H. Skepper, Assistant Principal Fruit Officer; Mr E. C. Connor, Principal Fruit Officer; Mr F. A. York, Special Agronomist (Fodder Conservation); Mr W. J. C. Hudson, Deputy Principal, Hawkesbury Agricultural College; Mr J. Strang, Assistant Principal Agronomist (Pastures); Mr D. M. Helwig, Special Veterinary Research Officer; Miss J. C. Kater, Special Veterinary Research Officer; Mr J. S. Jamieson, Personnel Officer; Mr J. H. Ballard, Assistant Principal Agronomist; Mr J. E. Jessup, Special Agronomist (Miscellaneous Crops); Mr S. W. Wise, Administrative Assistant (Personnel).

In all, 123 officers were promoted during the year. Forty-nine were promoted out of seniority order.

Retirements.—Dr Grahame Edgar, Director-General; Mr T. E. Kitamura, Principal Agronomist (Miscellaneous Crops); Mr E. C. Levitt, Special Fruit Officer; Mr F. R. Jones, Clerk, Board of Tick Control; Mr J. A. Ballantyne, Deputy Chief, Division of Horticulture, Mr C. R. G. Grant, Superintendent, Royal Botanic Gardens; Mr H. A. Browne, Architect.

Deaths.—Mr J. D. Bryden, Special Fruit Officer; Mr C. A. Fleming, Agronomist; Mr R. A. L. McDonagh, Livestock Officer (Pigs); Mr K. L. Elton, Clerk; Mr B. J. Russo, Clerk; Dr S. Bakalor, Special Dairy Officer.

OFFICERS OVERSEAS

Name	Designation	Duration	Reason for Visit
J. Nolan	Research Officer	15-8-65 to 14-8-68	Post-graduate studies at the University of California.
Dr A. T. Pugsley	Director, Agricultural Research Institute, Wagga	Aug. 65 to Jan. 66	Six months leave without pay to undertake a Senior Research Fellowship at Wellington, N.Z.
G. L. G. Lee	Livestock Research Officer (Apiculture)	9-9-65 to 8-9-67	Accept an Assistantship at University of California. Leave without pay for two years.
D. E. Wallin	Agronomist	14-9-65 13-9-66 approx.	Study cotton growing in U.S.A.
G. R. Hughes	Agronomist	24-9-65 to 23-9-68	Research Assistantship in the Dept. of Plant Pathology, University of Illinois and study for Ph.D.
A. N. A. Harris	Veterinary Officer	23-12-65 to 1-2-66	Visit N.Z. research centres—5 days on official business only and other period on recreation leave.
Dr W. V. Single	Director of Research, Agricultural Research Station, Tamworth	24-1-66 to 18-11-66	Visit wheat research centres in U.S.A., Japan, Canada, Europe, and U.K.
Dr J. M. Holder	Special Veterinary Officer	7-5-66 to 11-9-66	Attend 10th International Grassland Congress in Helsinki; 9th International Congress in Animal Production, Edinburgh; and visit research centres.
D. W. Crowfoot	Chief, Division of Dairying	6-6-66 to 26-9-66	Attend XVII International Dairy Congress in Munich; and visit Research Centres in U.S.A., U.K., and Europe.
C. Walkden-Brown	Special Agronomist	14-6-66 to 30-9-66	Investigate cereal production techniques, Europe, U.K., U.S.A.
S. G. Grimmett	Senior Agronomist	18-6-66 to 4-8-66	Attend 10th International Grasslands Congress, Helsinki; and visit pasture research centres in Finland and 12 other countries.
B. D. Ament	Regional Supervisor	29-6-66 to 30-10-66	Attend course in Agricultural Extension at Wageningen, The Netherlands, and to observe agricultural extension in U.S.A., Canada, U.K., and Europe.
G. M. Halloran	Senior Research Officer	Aug. 65 to 11-12-65	Wheat-collecting expedition, in conjunction with the Reading University Exploration Society to Afghanistan.
H. C. Kirton	Biometrician	28-8-65 to 27-8-66	Study leave in United Kingdom.
J. H. P. Dingle	Chemist	4-1-66 to 3-4-66	Study aspects of insecticidal residues in animal tissues, in U.S.A., U.K., and Canada.
Dr L. Fraser	Senior Biologist	25-3-66 to 10-7-66	Undertaking of a Colombo Plan assignment in India.
J. C. Keast	Director, Veterinary Research Station, Glenfield	27-5-65 to 7-9-65	International meeting on Hog Cholera and Swine Fever in Rome; Commonwealth Agricultural Bureaux Review Conference in London; and visit various laboratories and Institutions in Europe, U.K., and U.S.A.
Dr S. L. Macindoe	Chief Research Liaison Officer	26-4-65 to 21-12-65	On recreation and extended leave, with 30 days on duty to investigate and study agricultural matters.
Dr C. J. P. Magee	Chief, Division of Science Services	17-6-65 to 2-8-65	Attend Commonwealth Agricultural Bureaux Review Conference in London.
Miss H. I. Nicol	Biometrician	9-3-64 to 1-7-65	Recreation and leave without pay. Full-time duty at the Agricultural Research Council Unit of Statistics at Aberdeen University from 29-6-64 to 5-10-64.

PERSONNEL WORK

Induction.—Officers and employees taking up duty through head office were suitably inducted.

Eighty-seven new trainees were appointed early in 1966 for study at the Universities of Sydney, New South Wales, and New England, and at the Wagga and Hawkesbury Agricultural Colleges. The trainees attended a 10-day Induction Course, including eight days in residence at Bathurst.

There is now a record total of 231 Department of Agriculture trainees at the various Universities and Agricultural Colleges. Eighteen of these are repeating an academic year at personal expense.

Tutorials for In-Service Examinees.—Several clerical officers are undertaking the Regulation 116 Training Course organized by the Sydney Technical College for the Public Service Board. Classes were organized for Regulation 119 candidates. Field officers were advised in preparation for Regulation 124 examinations. Study material was made available to all candidates.

Study Leave.—This was arranged for numerous officers, for part-time University and Technical College courses.

Basic Supervision and Advanced Management Training.—Training courses for officers were organized by the Public Service Board.

Counselling and Adjustment.—Advice and guidance were provided for a number of officers. Some cases were referred to specialist officers at the Public Service Board.

First-Aid Service.—This was continued at Head Office. Provision of first-aid equipment for country institutions was supervised.

Career Inquiries.—Information concerning careers in agriculture was provided to career-advisers, parents, students and interested organizations. Appropriate Departmental publications were supplied.

Colombo Plan and Other Fellows.—Training was provided for 40 Fellows under the Colombo Plan, from Korea, Thailand, Pakistan, India, Malaysia, Laos, Philippines, Afganistan, Kenya, Uganda. Two Fellows from Ghana and two Fellows from Tanzania were provided with training under the Special Commonwealth African Assistance Plan. One Fellow from India undertook practical Agricultural Engineering training under the Commonwealth Scholarship and Fellowship Plan. The United Nations sponsored one Fellow from Kenya for training in sheep husbandry and shearing. One Colombo Plan Fellow is now in Third Year at Wagga Agricultural College, and another is in First Year at Hawkesbury Agricultural College.

Legal and Registration Branch

ACTS PASSED

These comprised the Milk (Decimal Currency) Act, 1965; the Meat Industry (Amendment) Act, 1966; and the Stock Diseases (Amendment) Act, 1966.

GAZETTALS

There were gazettals of 35 Regulations, 47 Proclamations and 67 Notifications.

PROSECUTIONS

Ninety-six prosecutions were made for offences under the various Acts administered by the Department.

ARBITRATIONS UNDER AGRICULTURAL HOLDINGS ACT, 1941

Four matters were referred to Arbitration under the Act.

REGISTRATIONS

Registrations effected during 1964–65 and 1965–66 are compared numerically in this tabulation:

	1964–65	1965–66
Apiary registrations	4,850	4,976
Potato licences	1,400	1,548
Stock foods	1,851	2,104
Stock medicines	1,613	1,746
Pest destroyers	1,767	1,851
Sheep brands	2,012	1,535
Sheep earmarks	2,315	1,806
Large stock brands	1,884	1,600
Fertilizers	852	703
Farm produce agents	297	296
Veterinary surgeons	527	567
Swine brands	1,085	1,174
Swine licences	140	42

VETERINARY SURGEONS BOARD

The Board met on 12 occasions. One veterinary surgeon passed the examination for registration.

STOCK MEDICINES BOARD

The Board met on 14 occasions. (See page 55, in Division of Animal Industry Report, for more detail of activities.)

Architect Branch

Funds Expended.—From Loan Funds, Consolidated Revenue Funds and Special Grants the amounts expended on new and maintenance work were as follows: Loan funds, $203,448; Consolidated Revenue funds, $44,278; Special Grants, $128,326.

Work Completed.—This comprised: at *Hawkesbury Agricultural College*: an extension to the machinery demonstration building; construction of a sheep nutrition building; construction of a glasshouse; re-roofing the Science Block, including gutters and downpipes; re-roofing the kitchen and dining-hall blocks; an extension to the by-product building (Dairy Products Factory); and electricity modifications at the School of Dairy Technology; at *Wagga Agricultural College*: construction of a cottage; extension of electricity supply to the irrigation area; construction of a sheep nutrition building; construction of a wool-classing lecture-building; alterations to the welding instruction shop; and construction of a glasshouse; at *Yanco Agricultural College and Research Station*: construction of concrete rice bays; electricity modifications at the Assembly Hall; modifications for the domestic amenity room; a toilet annex for the general office; construction of two hay sheds, a building for cotton work, and a glasshouse; at *Alstonville Tropical Fruit Research Station*: construction of a prefabricated steel machinery-shed and a glasshouse; at *Condobolin Agricultural Research Station*: construction of cottage; at *Grafton Agricultural Research Station*: extension of the town water supply to Station installations; a cooling system in an existing glasshouse; and construction of a seed storage room and a glasshouse; at *Narara Horticultural Research Station*: construction of a prefabricated steel machinery-shed, a cottage at Somersby Section and one at Narara; and supply and installation of benches and bench-heating and misting units; at *Narrabri Agricultural Research Station*: construction of a garage, a potting shed and an insectary; at *Trangie Agricultural Research Station*: construction of a sheep nutrition building and a cottage; at *Wollongbar Agricultural Research Station*: construction of a potting shed, and sow and boar pens; at *Centennial Park*: construction of a machinery and storage building, and a security fence (Bird Sanctuary); at *Glenfield Veterinary Research Station*: an extension to the isolation box, and construction of a small-animal house; at the *Royal Botanic Gardens*: construction of a glasshouse; in the *Tick Board of Control areas*: construction of a cottage at Mungindi and at Boggabilla, and a Stock Office at Wallangarra; at the *Agricultural Research Institute, Wagga*: construction of plant physiology field laboratory and field shelter, and completion of agronomy laboratories.

Work Still Proceeding.—This comprises: at *Yanco Agricultural College and Research Station*: an officers residential block, a wood-and metal-work shop, a machinery-demonstration building, and staff amenities building; at *Condobolin Agricultural Research Station*: construction of a cottage; at *Trangie Agricultural Research Station*: construction of a cottage; at *Narara Horticultural Research Station;* construction of a cottage; at *Hawkesbury Agricultural College*: an extension to the boiler house; at *Wagga Agricultural College*: extensions to the Graham Block which comprises biology room, library, lecture theatre and conference room, and construction of an engineering-demonstration building; at the *Queensland Border*: construction of cottages at Mungindi and Boggabilla.

Maintenance Work.—This comprised painting and repairs to cottages and/or farm buildings at the three Agricultural Colleges; also at the Research Stations sited at Alstonville, Condobolin, Cowra, Grafton, Griffith, Narara (and its Somersby section), Tamworth, Temora, Trangie, and Wollongbar; and at Queensland Border installations.

Extension Service.—Numerous inquiries about building problems on farms were attended to both by letter and personal interview. Plans representing farm buildings to an estimated value of $254,046 were supplied to farmers.

Pastures Protection Section

ADMINISTRATIVE RE-LOCATION OF SECTION

It has been decided that as from 1st July, 1966, the Pastures Protection Section will be in the Division of Animal Industry, and that the Pastures Protection Officer will also be the Registrar of Brands as from that date.

FIELD OFFICER ESTABLISHMENT INCREASED

In October, 1964, the Public Service Board had approved of increase in the Section's Field Officer numbers. The new establishment would provide for one Senior Field Officer and two Field Officers (with further consideration to be given to the creation of two more Field Officer positions after six months) and one Assistant Field Officer.

The salary range for the positions has been reviewed by the Public Service Board following unsuccessful attempts to recruit suitable persons. As a result, some appointments have been made. The appointment of one Field Officer took effect on 25th October, 1965. Another Field Officer took up duties on 27th June, 1966. Another will commence duty on 2nd August, 1966.

The services of four Field Officers will be distributed among the 48 Pastures Protection Districts in the Eastern and Central Divisions of the State, and an Assistant Field Officer will be trained to occupy eventually a Field Officer position.

Each Field Officer will be concerned with an allotted area, and three main aspects of field work, viz., travelling-stock reserves and routes, rabbit control methods, and methods of plague locust control during outbreaks.

RABBIT-CONTROL, TRAINING SCHOOLS, ETC.

School No. 19 for the training of Rangers and Rabbit Inspectors in the use of "1080" (sodium fluoroacetate) poison was held at Wellington in the Dubbo Pastures Protection Board area. In conjunction with this school, a field day was held for the benefit of Directors and staff of Pastures Protection Boards.

Such schools and field days have been conducted since 1958. Their beneficial effect has been apparent in the Pastures Protection Boards and their Rabbit Inspectors. These are affecting the attitudes of landholders in general, and especially with regard to the use of "1080" poison.

Twenty Pastures Protection Boards now operate, between them, a total of thirty complete "1080" poisoning units.

PLAGUE LOCUST

No incidence of plague locusts in "outbreak" proportions occurred in the 1965–66 season, but there was severe infestation by wingless grasshoppers in northern tableland areas in December, 1965. The Entomology Branch, Division of Science Services, has reported in detail (see page 82).

TRAVELLING-STOCK RESERVES

At 30th June, 1966, there were 473 applications in hand, from various persons, for areas of travelling-stock reserves which Pastures Protection Boards are unwilling to release. The areas are to be inspected by Field Officers of the Section, towards determination of the needs of travelling stock there.

PASTURES PROTECTION BOARDS' STAFF STATISTICS

	At 30–6–1965	At 30–6–1966
Veterinary Inspector	34	33
Secretaries	58	55
Rangers	65	66
Rabbit Inspectors	69	68

Biometrical Branch

GENERAL

This is a specialist branch in the design of investigational work and in methods research.

Advice on choice of most efficient designs and methods of conducting experiments has been available to all sections of the Department, either by consultation when plans were in preparation or as advice towards improvement of proposals formulated in Divisions.

At the close of specific investigations, the Branch has been available for mathematical-statistical examination of experimental results, estimation, measurement of association, summarization, testing hypotheses, and for critical report on conclusions to be drawn from the data and their reliability.

The volume of consulting work on the design of experiments and of computing work in the analysis of results each increased steeply. This flowed from recent increases in research establishment throughout the Department. Advice was tendered on a wide variety of subjects.

On the design side, the advice concerned such matters as: choice of fertilizer rates in experiments with pastures and field crops; sampling methods for soils, fruits, animals, and pastures; ancillary measurements for covariance adjustments; selection of sites, and size and arrangement of plots, for field experiments with fruit, field crops and pastures; and experimental designs proper. Mathematical-statistical analyses of the data obtained from experiments were done for numerous projects mentioned elsewhere in this Report of the Department.

This Biometrical Branch for most of the year also continued the data-processing of Official Herd Recording records—up to the production of Lactation Statements for dispatch to owners, and of Group Recording records up to the production of complete Lactation Cards. These operations will in future be done on the ADP Service Bureau's computer and the Punch Card Section of the Biometrical Branch will be responsible only for the punching and verifying of entry and sub-period cards for official recording and of entry and exit cards for Group Recording.

POST-GRADUATE ADVANCEMENT OF STAFF

Biometrician Miss H. I. Nicol returned in July, 1965, having gained the post-graduate Diploma in Statistics, with distinction, from the University of Aberdeen, Scotland. She had also worked for three months in the staff of the Computer Section, A.R.C. Unit of Statistics, Aberdeen.

Biometrician Mr H. C. Kirton proceeded overseas at the end of August, 1965, to undertake work for an M.Sc. degree in mathematical statistics at the University of Aberdeen. He will have subsequent study leave to work in the Statistics Department at Rothamsted Experiment Station, England.

RESEARCH STATIONS BRANCH

Scope

The Research Stations Branch is responsible for:

- Supervision and administration of the Department's 19 Research Stations;
- Supervision of farm operations at Hawkesbury Agricultural College, Wagga Agricultural College, Yanco Agricultural College and Research Station, and the Veterinary Research Station, Glenfield;
- Co-ordination and control of the Capital Works Programme for the Department.
- Direction and supervision of the Architect's Branch through which the Capital Works Programme is implemented;
- Maintenance of Public Watering Places, Western Division, and control of associated staff;
- Development of the Agricultural Machinery Advisory Service;
- Supervision of the purchase and maintenance of agricultural plant and machinery for Research Stations, also for the Division of Plant Industry project at Berry, the Royal Botanic Gardens and Centennial Park, and the Agricultural Research Institute, Wagga.

On request the Branch also gives advice on these matters to Division of Science Services.

Increased Administrative Role

The administrative activities of the Research Stations Branch were increased. Co-ordination and control of the Department's capital works programme, and direction and supervision of the Architect's Branch through which this programme will be implemented, have been added. Also, maintenance of Public Watering Places, Western Division, and control of the associated staff have been added.

Some staff increase was approved or effected. A new position of Assistant Principal Officer (Management) was approved and an appointment is pending. A Senior Clerk was appointed to help the Branch cope with the clerical work arising from the additional administrative responsibilities accepted by the Chief of Research Stations.

The Farm Mechanization Advisory Service continued to expand its activities, and demand for the services of the Agricultural Engineer and the Regional machinery advisory officers increased. Another machinery advisory officer has been appointed, shortly to take up duty in the North Coast Region. Thus, there is now such an officer in each of five of the nine Agricultural Regions and one at Yanco Agricultural College and Research Station.

The responsibilities of the Branch are classified broadly as:

Developmental—expenditures on acquisition of additional land, on capital works, equipment for the establishment, development, and expansion of Research Stations.

Operational—maintenance and improvement of Station lands and buildings; purchase, supply, maintenance, and repair of Station plant and equipment; provision of facilities and services, including labour, for the research establishment at Stations, and for the Agricultural Machinery Advisory Service and the Architect's Branch.

Developmental Aspects

Tropical Fruit Research Station, Alstonville.—Installation of a rising-main and pump and construction of a holding-reservoir for irrigation water supply were completed. The vegetable research programme for the north coast was transferred to the Station from Terranora and initial plantings were made.

Tobacco Research Station, Ashford.—An area of 33 acres was ripped, cleaned, and boundary-fenced. Pending further development the cleared area will be maintained under natural grasses.

Agricultural Research Station, Bathurst.—Extensions to the water reticulation system for irrigation were completed and now carry water to all sections.

Agricultural Research Station, Orange.—This Station was under the control of the Bathurst Agricultural Research Station Manager. Clearing continued and areas were fallowed for extensive spring potato-plantings for selection and research purposes. An area formerly part of the Bloomfield Hospital land has been added to the Research Station. Fencing of the boundary was completed.

Horticultural Research Station, Dareton.—The main drainage pipeline was completed, and a 2-cusec pump and motor were installed. A large area was cleared, towards extension of the irrigation area.

Agricultural Research Station, Grafton.—The Station was connected to the Lower Clarence County Council water supply scheme.

Agricultural Research Station, Narrabri.—Developmental work needed for the greatly expanded row-crop research programme included construction of a potting shed and insectary for use in cotton studies, and expansion of the irrigated area.

Yanco Agricultural College and Research Station.—The building programme proceeded to take the Farm Certificate Course facilities a stage further. Work on a residential block for officers, a wood- and metal-workshop, a machinery demonstration building and staff amenities block neared completion. Other works included construction of a work-building to house specialized plant and a glasshouse, each to facilitate the cotton research.

Other Research Stations.—On all other Stations work was done to provide additional facilities; either by the erection of new buildings, or replacement or modification of existing ones, or provision of plant and equipment.

Operational

BUILDINGS, FENCES, ROADS, AND AESTHETICS

On many of the Stations, building maintenance and extension works were completed, including modifications to accommodate specialized machinery for research. Minor repair and maintenance, including concrete work, running repairs to buildings and stockyards, and painting were done by farm labour. The report of the Architect's Branch (page 19) provides a detailed list of works.

A fencing-expenditure of $15,000 provided an extensive proprogramme of boundary-fencing of new areas, replacement of unserviceable sections and subdivision of paddocks. Major work was done on the boundaries of the new stations at Orange and Ashford and on internal fences at Condobolin, Dareton, Leeton, and Trangie.

The Advisory Service in farm fencing provided by Research Stations Branch was continued. Inquiries on fencing specifications and methods of conventional fencing increased. Greatly increased interest in electrical-fencing methods was evident. The inquiries in most cases were prompted by the need economically to fence areas being temporarily used for agistment because of drought conditions.

Road surveying and formation, for access and internal purposes continued to be a most important part of planning and development of the Research Stations with accent on all-weather accessibility. Spreading of shale on roads subject to traffic, and tar-sealing of entrance driveways and the surrounds of administration centres, were done on a number of the Stations. At Leeton, Wollongbar, Alstonville, Grafton, Trangie, and Bathurst the roadwork of this nature was completed.

Planting of trees for shade, shelter, windbreaks, and aesthetic purposes was extensive. Laying-out of lawns and gardens and appropriate regard for finishing-work in cement curbing, added to the appearance of administration centres. This has become a feature of Research Stations.

SOIL FERTILITY

The farming practices at the Stations aim to maintain high soil fertility. Soil conservation, quick establishment of native and sown pastures and crops, rotation in planting and grazing, close control of stocking rates, nutrition of crops and livestock, drainage and water conservation are typical of the programmes.

IRRIGATION

New works, and extensions to existing irrigation installations, were undertaken at a number of Stations. The work on a rising-main and the earthworks for the reservoir at Alstonville, and successful sealing of the excavation, were completed. Grafton Agricultural Research Station was connected to the Council water supply. At Bathurst, Orange, Dareton, Narrabri, and Narara extensions were carried out for expansion of irrigated areas.

FODDER PRODUCTION

Except under irrigation, pasture and lucerne hay production were very light. On the irrigated farms a considerable amount of pasture hay was harvested; at Leeton 500 tons were conserved, compared with 350 tons in the previous year.

Production of grain was the lowest for many seasons. There was no harvest at Trangie Station, and at Condobolin only 825 bushels—adding little to feed-grain reserves needed to face drought.

Very dry conditions persisted on all non-irrigated Stations until November, 1965, when good rains occurred on most Stations. Hand-feeding of stock and reduction in stock numbers were necessary in July and August on the inland Stations. The position was relieved later in the calendar year but hand-feeding was recommended late in May, 1966. In spite of the difficult year, the total fodder stored at 30th June, 1966, on the Stations that normally produce it comprised about 1,200 tons hay (valued at $59,740) and 18,000 bushels grain (valued at $21,664). These figures reflect the drought effect on grain production and a substantial fall in grain reserves.

On irrigated Stations hay production was very satisfactory. There, and on Stations which received rain, reserves were maintained at a reasonably safe level.

In the course of inter-Station transfers, the fodder transferred comprised 12,059 bushels wheat, 4,012 bushels oats, 450 bushels barley, 300 bushels other grain or seed, 200 tons pasture hay, 50 tons lucerne hay, and 20 tons other hay. The estimated value in total was $35,050.

SEED PRODUCTION WORK

Cereal pure-seed production continued on a number of Stations. Sufficient quantities were produced for their own requirements and for trials and pure-seed increase at other establishments. Seasonal conditions limited the production of pasture seed, but variety testing proceeded.

Seed-increase and pure-seed production of a number of miscellaneous crops continued at Yanco, Wollongbar, and Grafton Stations. At Narrabri Station, cotton seed in excess of needs was produced. A quantity of cotton seed was used in feeding-trials at Temora Station.

FRUIT PRODUCTION; AND ROOTSTOCKS

Seasonal conditions, including drought and cyclonic, seriously affected fruit crops on non-irrigated, coastal horticultural Stations. But considerable fruit was produced. This included about 27,500 bushels of tree fruits and 70 tons of grapes.

At Narara Station some 22,600 grape rootstocks were produced for use and for distribution to commercial growers.

LIVESTOCK

A general reduction in stock numbers was necessary because of drought conditions on the non-irrigated inland Stations. This was done by sale, or by transfer to other Stations more favourably placed. Despite shortages of feed, the well-managed use of fodder reserves maintained stock in satisfactory condition.

FARM MACHINERY

A number of major items of equipment, for farm and for research purposes, were purchased. These included: for *farm use*—tractors, headers, a cereal stripper, a land grader, a fertilizer distributor, slashers, a feed-pelleting machine, tip-trucks, a fruit grader, a hydrocooler, and other items; for *research use*—microscopes, humidifiers, a homogenizer, various electrical measuring-devices, electric balances, a constant-temperature cabinet, a de-ionizing unit, and other items.

Besides items of plant and equipment purchased from Consolidated Revenue Funds many items were purchased from Industry Funds for the Research Stations.

The policy of replacement of major items of machinery before their operation becomes costly or inefficient has demonstrated its advantages. The maintenance and repair needs are oversighted by Inspectors in the Research Stations Branch head-office establishment. Their close contact with plant and equipment on Stations, through frequent visits, has resulted in overall improvements.

LABOUR

Each Station Manager is responsible for supervision and selection of farm labour. The outdoor-staff numbers increased by 17 this year. The increase arose from extension of the overall research programme, the associated general maintenance work, and development of the new Station at Orange.

Public Watering Places

The Research Stations Branch now has the administrative responsibility also for maintenance of Public Watering Places, Western Division, and for control of associated staff. The Chief of Research Stations is Chairman of an inter-Departmental Committee set up to examine the whole question of Public Watering Places.

Expenditure on maintenance which was paid from Consolidated Revenue Fund amounted to $89,882. Also, a sum of $62,774 allocated as a supplementary appropriation for Drought Relief was spent on this work.

Some 300 Public Watering Places are located in the Western Division. Maintenance of these involves the Supervisor in considerable travel. A fully equipped caravan was supplied during 1965–66 for use by the Supervisor.

An extensive programme of desilting and reconditioning of tanks was undertaken during the year. Conditions favoured this work. Many tanks were empty. The dry conditions enabled contractors to move their plant over long distances and to work without interruption.

The Agricultural Engineer and the Farm Mechanization Advisory Service

THE AGRICULTURAL ENGINEER

Advice to Field Advisers.—The Agricultural Engineer devoted much time to keeping the Agricultural Machinery officers in the field informed, and to "in-service" training of recently appointed officers.

Personal Extension Activities.—The Agricultural Engineer's extension work included advice to landholders and to Government instrumentalities—by correspondence, telephone and personal discussion. He participated at 11 machinery field days and demonstrations of agricultural machinery, prepared material for and attended 31 meetings and conferences; chaired nine short-term schools, made six radio talks on tape for syndicated distribution, gave 21 talks at schools and meetings, and adjudicated for the Junior Farmers' Higher Awards Competition for Tractor Maintenance and Welding, the New Implement Awards at the Orange National Field Days and the Best Exhibit prizes at the Riverina Machinery Field Days.

His published work included ten articles for the *Agricultural Gazette of N.S.W.*, one paper for the 1965 Australian Cereal Agronomy Conference, and 26 items for the press.

"Safety" Committees.—The Agricultural Engineer served in the Advisory Committee for Safety in Rural Industries set up by the Minister of Labour and Industry, and in an inter-Departmental Committee on Occupational Health and Safety—advisory to the Public Service Board.

He tendered advice to the Commonwealth Department of Labour and National Service, towards a publication on "Electrical Safety". Twenty thousand of these booklets were received in due course and widely distributed in the State by the Department's extension services.

Standardization of Agricultural Machinery.—The Agricultural Engineer provided advice to the Standards Association of Australia, and was active in two Commonwealth Conferences in Melbourne in December, 1965, convened to investigate possible establishment of Australian standards for agricultural tractors and for agricultural implements and machinery.

Testing Agricultural Machinery.—The Agricultural Engineer served in two committees set up by the Australian Agricultural Council to investigate a proposal to establish an Australian Testing Station for agricultural machinery (other than tractors), and to inquire into all aspects of tractor testing in Australia. Two comprehensive reports on these subjects were subsequently submitted to the Australian Agricultural Council.

Film on Electricity in Agriculture.—The Agricultural Engineer, in association with the Electricity Authority of N.S.W., assisted the Department of Primary Industry and the Commonwealth Film Unit to prepare the script, locate sites and finally edit a film on "Electricity in Agriculture". This shortly will be released for extension purposes throughout the Commonwealth.

Assistance in Education.—The Agricultural Engineer acted as assessor in Agricultural Engineering examinations at the Department's Colleges. He set and marked the Public Service Board Regulation 124 Higher Grades examination paper on "Agricultural Engineering", and helped the Department of Education Syllabus Committee on "Farm Mechanics" for the High School Curriculum.

RESEARCH IN AGRICULTURAL ENGINEERING

The Branch has not the establishment to engage to any extent in research, but it tests agricultural machinery supplied from funds provided from the Commonwealth Agricultural Machinery Research Vote and Commonwealth Agricultural Extension Grant. The work was continued on a limited basis.

It is increasingly evident that investigational work on agricultural machinery and farm mechanization is essential, in part so that Agricultural Machinery officers in the field may be properly informed for greater benefit to the rural industry. Project-type inquiries on farm mechanization are also being received from landholder organizations. These require considerable research into whole-farm systems of mechanization. In this light the Public Service Board has created a position for an Agricultural Engineer to be engaged wholly on applied agricultural mechanization research. The position has been advertised.

Assistance was provided to the University College at Wollongong and the Wheat Industry Council in connection with research projects on grain cracking.

The Agricultural Engineer supervised a project on the development of a rotary sod-seeder designed to sow tropical legumes on the north coast, in locations and by methods for which existing machinery is unsuitable.

Under the supervision of the Agricultural Engineer, Agricultural Machinery officers are, at the request of landholder organizations, currently investigating: Californian methods of harvesting, bulk handling and dehydration for the prune industry; inefficiency in rice harvesting; bulk-handling of peaches and pears in the M.I.A.; orchard spraying-equipment for control of two-spotted spider mite; metal corrosion-resistant materials for storage of agricultural implements; and the suitability of farm machinery now being used by landholders in the Carabost district.

REGIONAL AGRICULTURAL MACHINERY OFFICERS

Their Locations.—Demand for decentralized Agricultural Machinery officer services continued to increase. Another officer has been appointed. He is to be located as Lismore after "in-service" training. There are now Agricultural Machinery officers for each of the following five Regions—South Western (headquarters Leeton), Southern (headquarters Wagga), Western (headquarters Orange), North Western (headquarters Gunnedah) and North Coast (headquarters Lismore).

Two Agricultural Machinery Officers are attached to the Yanco Agricultural College and Research Station. The Agricultural Engineer is responsible for their activities. They lecture in the Farm Certificate Course and supervise maintenance of plant and machinery at the Station.

The Regional officers advised landholders in the use, servicing, maintenance, and repair costs of agricultural machinery; and on purchasing, and replacement of suitable farm plant—in relation to the economic potential of the holding.

Diversity of Advice Sought.—These officers visited 1,078 farms. The diversity of advice sought of them is illustrated by the following examples, from individual visits: selection, adjustments, and servicing of tractors and farm vehicles; layouts and erection of farm buildings; selection of ploughs for specific tractors; performance of band-seeders; availability of bracken control equipment; techniques of handling fertilizers; problems with grain harvesting; assistance in design of bulk-handling equipment; selection of mowing equipment for orchards; assessment of loose-hay handling equipment; problems with forage harvesters, balers, bale loaders, rakes; inquiries regarding availability of pelleting and hay-wafering machinery; design of dehydrating-hay equipment and grain dryers; information on livestock-weighing devices; dips; dehorners; construction of yards and pens; information on bulk-handling and harvesting of potatoes; availability of stock-feed processing equipment; costs of spraying and seeding from aircraft; availability of olive presses; assessment of new types of clover seed-harvesters; selection of fork-lift trucks for orchardists; availability of frost protection devices in orchards; performance of orchard spraying units; selection of hydraulic pumps; pumping problems with hydraulic rams; sludge pumps and bore pumps; use of plastic syphons for irrigation; choosing water reticulation pipes; design of land planes; problems with posthole diggers, and types of electric fences; saw benches, safety devices; converting old trucks to trailers; assisting landholders in design of trailer hitches; electric welding equipment; spotlights on bushfire fighting equipment; details for farm workshop layouts and helping with selection of tools; advice on purchasing used farm-equipment; use of explosives in land clearing; and selection of complete farm-equipment for new farms.

On farm visits the attention of landholders was frequently drawn to unsafe practices and accident hazards.

Besides farm visits there were many office visits, mail, and telephone inquiries. One officer's report records that 854 inquiries were attended to by him in the last 12 months.

Special requests for information were received from landholders' organizations, e.g., modifications to orchard sprayers to get better control of two-spotted mite; suitability of machinery currently being used for agriculture in specific districts; design of tree-shakers for harvesting prunes and nuts; design of parallel-flow prune-dehydrators; and methods of making machinery less subject to corrosion in periods of non-use.

Assistance was given also to "farm group" advisers and farm-management consultants; e.g., on handling bulk fertilizers; machinery for picking up stones; electric fences; sowing equipment, and new types of fodder conservation machinery.

Dealer Liaison.—Close contact was maintained with machinery manufacturers, dealers, and agents in all regions where the service operates. This has been important in extension work, enabled greater participation in field days and a two-way exchange of information. One officer's report notes that manufacturers now seek information as to the suitability and sales potential of new equipment before introducing it to the Region. The officers averaged about 120 calls on machinery firms this year.

Group Extension.—The officers attended 43 field days at which agricultural machinery was shown, demonstrated, or discussed. They took an active part in the organization and running of the major machinery field days in their Regions.

Some special field days were organized, e.g., on tillage equipment, prune dehydrators, bulk handling of fruit, harvesting of summer crops. They attended other Departmental field days to answer inquiries on farm mechanization. They also attended field days organized by local dealers.

The Agricultural Machinery Officer at Orange acted as Publicity Officer and the Department's permanent member of the Orange National Field Days Committee. The event drew 50,000 people, over four days. He was involved in 32 committee meetings, the issue of 25 publicity statements, and the compilation of the 140-page programme. The Agricultural Machinery Officer in the Riverina similarly assisted for a Field Day at Narrandera which, though unfortunately washed out by rain, drew 300. He helped to provide a Summer Crop Field Day at Berrigan where 1,000 attended. In the Southern Region the organizers of the Wagga and Henty Machinery Field Days were assisted, and these days drew 800 and 3,000 people.

Nine Tractor-Maintenance Schools were held in Mid Coast, South Western, and Western Regions. Attendances aggregated 294 enrollees. Seven schools in Electric Welding were held, in South Western, Southern, and Western Regions, attended by 145 enrollees.

The Agricultural Engineering Society of the Riverina, formed two years ago largely by the efforts of the Regional Machinery Officer, held 10 meetings this year to discuss aspects of farm mechanization. One of the meetings drew more than 100 people. Some of the talks delivered at these meetings were processed and used in extension work.

The Regional Agricultural Machinery Officers also gave a total of 31 talks at Agricultural Bureau and other primary producer meetings.

Mass Media.—More than 160 radio talks were recorded by the Agricultural Machinery officers for use by various rural radio stations. The officers also participated in eight television programmes, and helped to prepare visual aids for other officers.

Fifty-eight items were supplied to the rural press. Five articles were prepared for the *Agricultural Gazette of New South Wales.*

DIVISION OF PLANT INDUSTRY

Extension

GENERAL

The District agronomist of today finds that he has as associates in the extension field numerous other forces, including Commonwealth Departments, Universities, fertilizer firms and others promoting commercial aids to production, Farm Advisory Groups employing Advisers, and Farm Management Consultants in private practice. Meantime, the farmer of today has better educational standards than in the past and is moreover well aware of latest developments, through his newspapers, journals, radio and television.

This is a "new era" in extension. It demands that officers shall have not only more and more technical knowledge but a keen and clear appreciation of the economic impact of new agricultural techniques. They have to fit themselves for the "whole-farm approach", if for no other reason than that in the competitive modern agriculture, farmers are no longer satisfied with "unrelated pieces of extension advice". They expect and increasingly demand an integrated plan for their property.

A District agronomist unable to cope with these increasing pressures, by concentration of effort on his primary duty—extension service—risks becoming little more than a technical assistant conducting trials, providing *ad hoc* routine advice and attending to routine regulatory duties.

There is apparent ever-increasing awareness among District agronomists of the need to programme objectives and plan their extension work in that light.

Their use of mass media, the radio, press, and television, is presenting extensive information to a large number of people in short time. One immediate effect is the considerable build-up in the demand for personal contact.

Mass media can most often accomplish only some of the steps in the extension process towards farmer adoption of extension information or advice. Use of progressive farmers and individual contacts is essential but this too is only the beginning of progress towards widespread adoption of changes in practice. It follows that agronomists are increasingly aware of the need to "define", and use objectively in their extension work-plans, the informal "reference group"—the group wherein a farmer relates and equates his farming behaviour.

THE AGRONOMY EXTENSION STAFF

Lack of trained staff in sufficient numbers continues to limit the Department's aim to provide a better service by reducing the size of agronomist Districts. Staff continues to be lost not only by retirements but by resignations and secondments and unfortunately many of those lost are the experienced officers.

This year, two District agronomists resigned to take up family farming interests; three were seconded to positions of Manager of an Agricultural Research Station; the Assistant Principal Agronomist (Extension), Mr F. Autry-Hall was seconded to the position of Regional Supervisor, North Coast Region; and two agronomists were granted study leave.

Mr G. A. Crawford, formerly Regional Supervisor, South Western Region, Leeton, took up duty as Assistant Principal Agronomist (Extension), vice Mr F. Autry-Hall, in March, 1966.

NEW AGRONOMIST DISTRICTS

Three new agronomist Districts were established: Bourke, Narrabri, and Warren. There are now 40 districts. But unfortunately, due to an unexpected resignation and three secondments, it has not been possible to appoint an agronomist to Warren nor fill the vacant positions at West Wyalong and Tumut.

NEW DISTRICT AGRONOMISTS

Eight agronomists who had completed training in extension were appointed to District positions.

TRAINING-POOL FOR EXTENSION OFFICERS

The "training agronomists for extension" scheme aims at providing a pool of argonomists with basic knowledge of the duties and responsibilities of a District officer. The scheme has operated since 1962 and is a success. But, because of continued loss of experienced staff the pool of young staff trained for a District allocation has reached a critically low level.

DISTRICT AGRONOMIST ACTIVITIES—SOME STATISTICS

In 1965–66 there were 251 working days, less a per-officer average of 15 days' recreation leave and 7 days' sick or other leave. A District agronomist on average thus worked 229 days; spent 82 of these on office work, including preparation of press, radio and television materials, and reading, and 12 at conferences and meetings. The balance, 135 days, was spent in the field—for farm visits, field days, investigations or trials in crops and pastures, land settlement matters, seed-certification and registered-seed matters, farm competitions, agricultural shows, and flood, fire and drought matters under inquiry or report.

The drought conditions made this a more than usually difficult year for the extension worker as well as the farmer. For example, in some districts there was the organization of distribution of relief fodder, some by purchase and some by gift; one District agronomist spent 41 days on this area of activity.

District agronomists participated in not less than 169 field days, 182 meetings, 758 radio broadcasts, and 18 television sessions; made not less than 686 press releases, in addition to the much greater number of times when they or their reports were consulted by pressmen; and participated in many of the short schools for farmers.

The trials and demonstrations conducted on co-operating farms by District agronomists aggregated 871, as follows: 72 with wheat, 27 with oats, 11 with barley, 18 with maize, 81 with rice, 7 with oil crops, 10 with vegetables, 10 with cotton, and 23 with various other crops; 462 U.P.S.E.T.'s, concerned with pastures, 62 other trials with pasture, and 188 pasture demonstrations arising from the Dairy Industry Extension Services Grant or the Commonwealth Agricultural Extension Services Grant.

Research

GENERAL

Increase in Establishment.—Ten graduates were recruited for research. Four research agronomists resigned. One research agronomist died in a road accident.

Of the ten graduates recruited, seven are employed under funds provided by the Wool Industry Research Committee (4), the Meat Research Committee (2), or the Wheat Industry Research Committee (1).

CSIRO Co-operation in Training.—The four new research officers employed by use of Wool Industry Research Committee funds have been stationed with the CSIRO Division of Plant Industry, Canberra, for three years, for advanced training *and* co-operative research.

That facet of co-operation by the CSIRO is an extension of the "1-year advanced training" scheme introduced for plant breeders by the CSIRO in 1964–65. Two Department of Agriculture plant breeders were in this course during the year.

Forage-Introduction Research Committee with CSIRO.—The co-operative relationships with CSIRO Division of Plant Industry has this year resulted also in formation of a research committee to integrate the work of the two institutions on forage-plant introductions.

Locations of New Research Officers.—The new officer appointed on salary from the Wheat Industry Research Committee funds has been stationed at Cowra Agricultural Research Station. This has enabled commencement of a programme of wheat-plant nutrition-research for the higher rainfall areas of the central west.

Of the three new officers appointed on salaries from the Meat Industry Research Committee funds one has been stationed at the University of New England, for research into the agronomic aspects of beef cattle bloat-control. The two others are at Glen Innes Agricultural Research Station for pasture-utilization research.

The four appointed on salaries from the Wool Industry Research Committee funds are, as reported earlier, located with the CSIRO Plant Industry Division for three years.

The other three of the ten new research officers are located as follows: one at Narrabri Agricultural Research Station for research in cotton-culture and nutrition; one at Orange Agricultural Research Station to initiate a potato-breeding programme and other potato research; and one at Yanco Agricultural Research Station to replace, on cotton-culture research, an agronomist who resigned.

Vacant Research Positions.—At 30th June, 1966, there were nine vacant research positions in the Division of Plant Industry.

Plant Introductions, and Exchanges

Some 439 plant introductions were made. Some 250 seed samples were sent to overseas research workers.

Services to Land Settlement

The Principal Agronomist (Extension) co-ordinates this Department's services to closer settlement activities, confers with the Chairman of the Closer Settlement Advisory Board, arranges inspections of Estates by officers of this Department and oversights and submits their reports. He liaises with the Closer Settlement Boards.

The work carried out by agronomists in connection with the selection of Estates, their subsequent design into farms, and at a later stage, advice given to new settlers, does play an important part in implementing the land settlement scheme.

This year the Principal Agronomist (Extension) in company with Board members inspected fourteen Estates comprising about 178,875 acres.

He also inspected, with District agronomists, five War Service Land Settlement Estates, comprising 24 blocks and about 30,000 acres. The visits were made with a view to improving the position for settlers experiencing financial problems.

The tempo of land settlement under the Closer Settlement Scheme has slackened, but demand on services of District agronomists remained high. The agronomists were called upon to inspect and report on a number of Estates, and advise settlers in farm-development difficulties.

District agronomists were involved in inspections of twenty Estates, comprising about 343,106 acres. This included participation in the preparation of topographical maps and the design of farms.

COLEAMBALLY IRRIGATION AREA FARMS

Two large-area farms and three horticultural farms were added in 1965–66 to the Coleambally Irrigation Area total of farms settled, bringing the total to 208 as at 30th June, 1966.

There will be a lull until 1968, when another 70 blocks are expected to become available, followed by 50 more blocks about 12 months later.

The Water Conservation and Irrigation Commission's programme is aimed at settling the whole of the area within 10 years from the date of completion of Blowering Dam.

Services to Irrigation

The water supply position is in a critical state. Substantial rainfalls at sufficient intensity for "run-off" are gravely needed. The Water Conservation and Irrigation Commission in husbanding the available supplies in the major dams on the inland rivers and the Hunter has had to impose unprecedented controls on irrigation by pumping from rivers. The Department of Agriculture has co-operated with the Commission in many aspects of its work.

The number of irrigation plants installed throughout the State has undergone another big increase. But shortage of water in rivers and streams and the surface-catchment dams on farms has prevented full use of old and new installations.

There have been cases of formerly "safe" supplies of underground waters from wells showing reduced water levels or complete failure, e.g. the river flats at Mudgee. On the other hand there has been spectacular development of irrigation of row crops such as maize and grain sorghum in the Quirindi-Caroona-Breeza districts—by drawing water from previously untapped underground sources. An estimated $1,000,000 has been expended there on irrigation installation and associated row-crop equipment.

In the lower Lachlan River valley vast quantities of underground water have been discovered between the 300 ft to 450 ft levels and a number of bores have been drilled into this basin. One of these is yielding 100,000 gallons per hour. The majority are yielding about 40,000 gallons per hour. Up to 200 acres of irrigation either by flooding or spraying is being developed at such sites.

Irrigation development in the Namoi Valley, mainly from the river and dependent on Keepit Dam, will be checked in the coming year by the low state of storage. Cotton growers in particular are embarking on drilling programmes to tap underground supplies.

Landholders along most inland rivers are installing irrigation systems. Even in hitherto "safe" areas there is great activity in this field. For example: 50 bores have been drilled in the Armidale district; 90 new installations have been made in the Inverell district; and there is intense activity in water supply schemes at Narrandera, at Hay, in Jemalong Shire, and many other places.

Further meetings of the Committees appointed to investigate and advise the Government on irrigation development in the Macquarie and Gwydir Valleys were held. The Department is represented in these Committees. Inspections of properties were made and evidence was collected from landholders.

The Department advised the Water Conservation and Irrigation Commission on cases, under the Farm Water Supplies Act, where an advance in excess of $4,000 was sought for purchase and installation of irrigation plant. At the start of this year eight such applications were under attention in the Department of Agriculture. During the year 141 new applications were received. All but 14 of these were reported on. There were 86 applications in 1964–65 and 57 in 1963–64.

Other cases of advice to the Water Conservation and Irrigation Commission, but not subject of applications for loans, were concerned with agronomic matters influencing proper design of irrigation plants.

A lot of inquiries from landholders and others concerned irrigation development by flood or spray, irrigation crops and pastures, construction and desilting of dams, prevention of seepage from dams, and evaporation losses. Also there were inquiries about drainage.

The Drafting Sub-committee on Spray Irrigation appointed by the Australian Standards Association continued its work. Numerous comments were received from people, firms and departments interested in the code the sub-committee is formulating. Some of the comments were used in a revision and the code is now near to a final proof.

The Special Agronomist (Irrigation) represented the Department in a number of Committees and attended their meetings in the following frequencies: Hunter Valley Conservation Trust and its Sub-committee meetings (18 meetings); Standards Association of Australia, Irrigation Drafting Sub-committee (4 meetings). Water Research Foundation—State Committee and Research Sub-committee (4 meetings); Yanco Agricultural College Course Committee (2 meetings); and the Burrendong and Macquarie River Committee, and Water Allocation Committee for Irrigation Districts (4 meetings); total—32 meetings.

Demand for copies of the sixth edition of the Departmental Bulletin No. P176, *Irrigation Farming*, received from the printer in March, has been so great that the edition has already been re-submitted for a further printing.

A new Bulletin, No. P336, *Principles of Irrigation* was completed and is at the Printery. It is a semi-technical bulletin interpreting research results for practical use by irrigators.

Weeds Work

NOXIOUS PLANTS ADMINISTRATION

Many matters have been referred this year to the Noxious Plants Advisory Committee of which the Departmental representative is Chairman. The Committee has become the main line of co-ordination between the Department of Local Government and this Department on weeds matters and has strengthened liaison with Local Government bodies. Many of the Committee recommendations have been based on investigations and reports by District agronomists.

A majority activity was related to allocation of the increased grant, $400,000, made available to Councils by the Department of Local Government. Allocations were made to eight County Councils ($153,350), 102 Shire Councils ($164,800) and 30 Municipal Councils ($11,450). More Councils than ever before sought assistance. Only eight rural Shires did not seek it.

Councils' activities in noxious plant control have improved. Some Councils have appointed weed inspectors for the first time. And many have shown more interest in extension of noxious-plant control-programmes to private lands, including implementation of powers of entry on to private lands and treatment at the landholder's cost where reasonable control measures have not been undertaken. Unfortunately, some Councils are still relatively inactive in this field.

In allocating assistance to Councils particular emphasis was placed on educational activities coupled with inspection and enforcement of control of the more dangerous weeds, and on a positive approach to such problems as infestations on vacant Crown lands. In a number of cases the full cost of treatment of Crown lands has been borne by the grant funds.

The Noxious Plants Advisory Committee held six meetings and several members visited the far north coast to inspect special problems. Also, the Chairman attended meetings of Councils at Goulburn, Balranald, and Walgett to discuss noxious weed control problems and visited some of the Councils in the Northern Agricultural Region.

Regional Supervisors and District agronomists maintained liaison with most Councils in the technical and administrative aspects of noxious plant control.

HERBICIDES IN DEVELOPMENT OF TIMBERED LAND

Despite the prevailing dry conditions' adverse effect on herbicide efficiency, the use of herbicides for destruction of timber prior to establishment of pastures has notably increased.

Picloram has been used quite widely. About 50,000 acres were treated by the partial frill method. Various eucalypts were the principal trees treated. Despite varied responses, as between species, the results have been most promising. The timber so treated is left standing and aircraft are used to sow and fertilize the treated land.

An invert emulsion of 2,4,5-T has also been applied, from aircraft, on several thousand acres, to destroy eucalypt regrowth which followed bulldozing of the parent trees.

MORE ACCEPTANCE OF PASTURE IMPROVEMENT IN WEED CONTROL

Landholder acceptance of the role of pasture improvement in weed control in grazing lands has significantly increased. Acceptance of this principle for control of serrated tussock (*Nasella trichotoma*) has become wider spread on the central tablelands and is becoming significant on the southern tablelands.

Pastures are now being used also for control of St John's wort (*Hypericum perforatum*) on the central tablelands, where it has been accepted practice for about 30 years on the southwest slopes.

Development of pasture species for the sub-tropical north coast areas has this year been followed by notable farmer-interest in use of the species to prevent re-establishment of lantana (*Lantana camara*) and Crofton weed (*Eupatorium adenophorum*) after these weeds have been destroyed by other means. For many years spraying has been the basis of control, and no follow-up action was pursued, despite the certainty of re-infestation.

Landholder acceptance of the pasture-improvement principle in weed control has been a difficult extension-problem.

ANNUAL GRASSES AS WEEDS IN CEREALS

Increasing interest in annual grasses as weeds of winter cereals has been noted. The main species concerned are Wimmera rye grass (*Lolium rigidum*), wild oats (*Avena* spp.), barley grass (*Hordeum leporinum*) and several of the annual brome grasses (*Bromus* spp.). It reflects largely the consequence of adoption of shorter fallows by many farmers and the removal of some broad-leaved weeds by use of 2,4-D.

Three herbicides, diallate, triallate and barban have been increasingly used for control of the grasses in wheat and barley.

DAMAGE BY HERBICIDES

There have been some reports of crop damage through misuse of herbicides or by misadventure.

Near Griffith, some 700 acres of cotton and 200 acres of tomatoes showed 2,4–D-like symptoms after being sprayed from the air with an insecticide. The damage appeared to be the result of contaminated equipment. There seemed to be no significant loss of yield.

Along the Murray Valley, several sultana producers suffered yield-loss following drift of 2,4–D sprayed on nearby wheat at the sultana bud-burst stage.

Elsewhere, there were reports of minor damage to crops by hormones after using mist applicators.

One report was of a maize crop destroyed when sprayed with bromacil, which is not recommended for use in maize. The same herbicide also damaged apples when mistakenly used in place of an insecticide.

A cauliflower planting was destroyed, by atrazine residues in the soil, when transplanted to land sprayed about six weeks earlier for control of weeds in sweet corn.

Several reports were of ornamental trees or shrubs destroyed by absorption of residual herbicides applied around poles and along footpaths.

Problems in use of barban to control wild oats in wheat have been mentioned elsewhere.

THE DROUGHT AND WEEDS

The drought has greatly reduced infestations by a number of perennial weeds, especially galvanised burr (*Bassia birchii*). On the other hand there is already an increase in some weeds as an effect of the drought.

The rains during the summer were sufficient to produce several heavy crops of Bathurst burr (*Xanthium spinosum*), particularly as there has been little pasture in competition with the burr seedlings.

Similarly, fireweed (*Senecio lautus*) encouraged by light rains was particularly prevalent in the Hunter Valley and on the central coast last spring due to lack of competition. Indeed, fireweed prevalence on some properties was such that purchased fodder was blamed for its spread.

Common heliotrope (*Heliotropium europaeum*) was far more prevalent in southern districts this year after the summer rains and lacking competition.

Much of the recently sown wheat crop is very weedy despite a long fallow. There had not been enough rain to germinate the weeds prior to wheat sowing.

Examination of hay purchased from other districts for drought-feeding showed that most was satisfactory in terms of weeds. There was some contamination by barley grass (*Hordeum leporinum*) and Paterson's curse (*Echium plantagineum*) but there have been reports of only two serious weeds in the hay. These weeds were St John's wort (*Hypericum perforatum*) and spiny burr grass (*Cenchrus pauciflorus*).

Noogoora burr (*Xanthium chinense*) was reported in maize grain. No skeleton weed (*Chondrilla juncea*) was detected in wheat translocated to the northwest from infested southern areas.

WEEDS RESEARCH

A long backlog of work and shortage of experienced field research staff prevented spectacular advances. But progress has been made and new staff have gained valuable experience. There are now four weeds research agronomists, and three of these are recent appointees. Individual research programmes have been developed and liaison so established between them that the limited research resources will be best used.

Examination of weed control problems in crops is the main basis of the programmes, but some basic aspects are also receiving attention.

Weed control in vegetable crops was investigated at Hawkesbury College, particularly in carrots and onions. Many herbicides were screened, for use over a range of other vegetables, to pave the way for subsequent detailed research in a number of vegetables.

Also at Hawkesbury College, reported extensive damage to some wheat varieties sprayed with the barban to control wild oats was checked in a trial. The findings were that whilst some varieties were highly susceptible, Festiguay in particular, there was no damage in any of the seven varieties tested where the spraying was done correctly.

Weed control in cotton and rice was subject of research at Yanco Agricultural College and Research Station. Screenings yielded five herbicides for future development in relation to cotton. The herbicide molinate, tested over a range of rates and times of application, was cleared for field-testing in rice.

Weeds research work at Tamworth Agricultural Research Station was greatly restricted by the drought, but some work on weed control in cereal crops was initiated.

At and from Bathurst, serrated tussock (*Nasella Trichotoma*) research continued. Several trials were established, also, on the southern tablelands. Results showed that principles of control established in areas near Bathurst are widely applicable. Research into this weed and its control provided the material for a thesis which gained this year the M.Sc.Agr. degree of the University of Sydney for the officer concerned, Mr M. H. Campbell.

Development of bio-assay techniques to determine herbicide residues remaining in the soil is proceeding at Hawkesbury College. This research has important implications because of the number of herbicides which remain active in the soil for long periods, and damage subsequent crops

Increased cotton acreage and the extreme susceptibility of cotton to 2,4–D has led to work at Yanco. The search for safe, cheap, and effective methods or chemicals to control burrs (*Xanthium* spp.) and other 2,4–D susceptible weeds growing near cotton has indicated that the problem can be alleviated by developments in equipment, in 2,4–D formulation, and in new herbicides.

At Bathurst, research to evaluate herbicides for use in pasture establishment has been started. Reduced cultivation in preparing seedbeds is of interest, offering reduced costs and at the same time increased reliability of establishment because of less weed-competition. In particular, this work seeks to develop methods for non-arable land.

WEEDS CONFERENCES AND SCHOOLS

At the Australian Weed Research Conference, held at Toowoomba, in July, 1965, four of the Department's agronomists contributed papers. Two dealt with research results and two reviewed a particular field.

A first conference of Departmental weed research agronomists was held at Hawkesbury Agricultural College in May, 1966. It enabled a thorough examination of research objectives, methods, and equipment. Research administrators from other fields participated in some of the sessions. In conjunction, a conference was held with development officers of herbicide companies—to discuss research and extension co-ordination between Government and industry, and also herbicide registration problems under the Pest Destroyers Act.

A three-day school was held at Orange in May, in particular for council weeds officers—on the principles and practice of weed control, and on noxious plant administration problems. More than forty persons attended.

The Weed Society of N.S.W. was formed this year. It is a technical society open to all interested in weeds and their control. Weeds agronomists of the Department have been active in developing it.

WEEDS PUBLICATIONS

As well as publication of articles in various scientific and agricultural journals, the officers of the Weeds Section have completed a revision of parts of the *Weeds* book (sale publication) for a second edition. They have also prepared material for a *Weeds Workbook* to be issued to Government and semi-Government personnel involved in weed control—as an aid to keeping up with developments.

Pastures Work

PASTURES SECTION RESPONSIBILITIES

Pasture research and extension, organization of pasture seed production and certification, administration of the Seed Testing Laboratory, and inspections under various Acts including the Agricultural Seeds Act and the Stock Foods and Medicines Act comprise the Pasture Section's responsibilities in the Division of Plant Industry.

PASTURE IMPROVEMENT STATISTICS

Statistics in 1964–65 indicated 11,313,891 acres in N.S.W. sown to pastures, including an increase of 618,000 acres in that year. However, these figures are approximations—including use of the differences between new acreage sown and acreage ploughed up for wheat and other cereals.

Of significance also is the increase in acreage of green forage crops—from 1,691,000 acres in 1960–61 to 2,397,000 acres in 1964–65.

These figures for pasture sowings and forage crops—and by including also 916,000 acres sown to oats for grain, hay, and grazing—add up to about 7 per cent of the total acreage of New South Wales holdings. Sown pasture acreage represents only 5 per cent of the State acreage, and only 14 per cent of the 70,000,000 acres of readily "pasture-improvable" lands in the 15-in to 20-in rainfall sectors of N.S.W.

Current crop-acreages indicate a record total sown to wheat, with inroads into the "pasture phase" in wheat areas. Shortage of funds in this second year of the drought has limited the amount of pasture undersown with the current wheat crop. The decade ahead seems destined to be featured by marked expansion in acreage of sown pasture, especially in non-arable tableland areas. This will be in response to increased superphosphate production by the two main companies, more active promotion, continued increase in numbers of agricultural aircraft, and more co-ordinated group-planning to facilitate delivery and air-spread operations.

In 1964–65, some 9,815,173 acres were aerially topdressed and/or seeded—about 86 per cent of the total sown-pasture acreage. Currently there is a trend back to ground-spread methods in arable, wheat areas.

PASTURE RESEARCH

SCOPE

Research continued with introduced species, species evaluation, establishment methods, seasonal growth performances, plant breeding, plant-animal relationships, plant nutrition, pasture physiology and ecology, "feed-year" synthesis, and management and utilization systems. In the relevant aspects co-operation was maintained with livestock research officers of the Division of Animal Industry and economics research officers of the Division of Marketing and Agricultural Economics.

The continued drought enabled some compensatory progress in the study of management systems under stress, and some observations on relative drought-tolerances of pasture species.

STAFF RECRUITMENT AND TRAINING

A programme has been implemented, in co-operation with the CSIRO, Canberra, to train research agronomists to investigate problems in aerial pasture establishment, regional pasture improvement, plant nutrition, and seed physiology. The agronomists concerned will train and do research under CSIRO leaders in these particular fields.

Three more appointments have been approved. The appointees are to undertake two-year training courses, pending appointment to species-evaluation regional centres in N.S.W. In their first year they will train at the Plant Introduction Section, CSIRO, Canberra, and in their second year at the Grassland Agronomy Section, CSIRO, Canberra.

The policy of encouraging pasture research agronomists to register for M.Sc. and Ph.D. post-graduate study courses has been further pursued. Mr J. Murtagh has completed requirements for his Ph.D. degree at North Carolina University, U.S.A., and Mr S. G. Grimmett has been seconded for two years to the University of New South Wales for research leading to an advanced degree.

LIAISON AND CO-OPERATION WITH OTHER ORGANIZATIONS

The availability of funds from industry sources, the Rural Credits Development Fund of the Reserve Bank, and from Commonwealth Extension Grants, has increased the volume of research in livestock production as affected by pasture management and utilization, and the "whole-farm" studies.

A New South Wales Forage Introduction Research Committee has been collaboratively set up by this Department and the CSIRO Division of Plant Industry, to co-ordinate and facilitate the testing of herbage-plant introductions throughout N.S.W.

The New South Wales Herbage Plant Liaison Committee held two meetings (Cowra and Canberra) to promote the orderly release and seed production of new cultivars of forage plants. At Cowra, liaison was promoted with the New South Wales Seed Grower's Association. At Canberra, opportunity was taken to see recent developments in herbage-plant breeding. The Victorian Herbage Plant Liaison Committee also participated in this meeting.

TENTH INTERNATIONAL GRASSLAND CONGRESS—PAPERS PRESENTED

Dr J. Holder and Mr S. G. Grimmett attended the Tenth International Grassland Congress at Helsinki, Finland, and visited research centres in travelling to and from the Congress. Dr Holder presented a paper "Production of dairy cattle from an improved pasture system in a subtropical environment" co-authored with Colman, R. L., and Swain, F. G. (1966). Mr Grimmett presented a paper "Properties of pasture plants and their effect on physiological development and production of sheep".

INTRODUCTION OF PASTURE SPECIES

Collection of indigenous, endemic, and exotic species for breeding or introduction and testing in different environments proceeded as a major function. The collected material this year included grasses, legumes, and herbs representing temperate, Mediterranean subtropical, tropical, and semi-arid zones. Some were from overseas and some from within Australia.

Plant introductions included from Russia a collection of lucernes (*Medicago sativa*); *Trifolium alexandrinum, T. vesiculosum, T. repens, Lotus corniculatus, Medicago rugosa,* and *T. hirtum.* Grasses included *Agropyron* spp., *Phalaris* spp., *Bromus* spp., *Hordeum* spp., *Eragrostis* spp., *Cynodon* spp., *Festuca* spp., from various overseas countries and from the CSIRO and other Departments of Agriculture in Australia.

Plants had been collected in Latin-American "high altitude-low altitude" environments in 1964–65 by the Principal Agronomist (Pastures) in the hope that they would show frost-tolerance and good winter-growth in appropriate Australian environments. They were first forwarded to the USDA, Beltsville, U.S.A., and thence to CSIRO, Canberra. Following registration (CPI No.) they have been divided into: *"semi-arids"*, which have been sent to the Soil Conservation Service, Condobolin, and the CSIRO, Deniliquin; *"temperates"*, which have been sent to the CSIRO, Canberra; *"subtropicals"*, which have been sent to Grafton Agricultural Research Station, and the CSIRO, Brisbane; *"tropicals"*, to the CSIRO, Brisbane; *"decoratives"*, to the Botanic Gardens in New South Wales and Queensland. Some have been retained in cold storage at Canberra pending arrangements for testing and seed increase.

Genera accessioned in 1965–66 included *Rigitaria, Eragostis, Setaria, Brachiaria, Paspalum, Crotalaria, Aeschynomene, Phaseolus, Rhyncosia, Desmodium, Glycine, Stylosanthes, Stizolobium, Lespedeza, Puccinellia, Sesbania,* and *Vigna.* The sources included Mexico, Honduras, Nicaragua, Costa Rica, Guatemala, Bolivia, Ecuador, and Brazil.

TESTING OF SPECIES

Preliminary Evaluation.—Selected "temperates", "Mediterraneans", and "semi-arids" were forwarded to Condobolin, Trangie, Berry, and Yanco, for seed increase. But the major site for new introductions was Grafton Agricultural Research Station.

At Grafton, two main quarantine-area observational nurseries are conducted, on "red soil" and "sandy soil", in which 400 and 250 accessions, respectively, were grown in 1965–66. Promise was noted in many species, including: *Chloris gayana* P.599, P.595, P.623, P.618, P.611; *Cynodon dactylon* P.6935, P.6936, P6559; *Cynodon plectostachyus* (naturalized); *Digitaria decumbens* P.1376; *Pennisetum clandestinum* P.713; *Setaria sphacelata* P.6964; *Setaria splendida* P.6968, P.6969; *Eragostis curvula* P.648, P.6860 P.6861, P.6859; Paspalum *notatum* P.6875, P.1308; *Glycine tomentella* (Native); *Glycine tabacina* (Native); *Stylosanthes humilis* P.6944, P6908; *Stylosanthes gracilis* P.1072, P.1466; *Stylosanthes mucronata* P.6912; *Aeschynomene falcata* P.23; *Psoralea tenax* (P6518 (Native); *Phaseolus angularis* P.6710; and *Desmodium* spp. (several new unidentified introductions).

Advanced Testing.—In district trials *Siratro, Lotononis, Leucaena glauca, Aeschynomene,* Townsville lucerne, *Lespedeza striata, Kennedia rubicunda, Trifolium repens,* Ladino, and endemic white clovers are the promising legumes. *Paspalum regnellii, Chloris, Brachiaria, Cynodon,* and *Setaria sphacelata* cv Kazungula appear promising grasses.

In sward trials of subtropicals *Aeschynomene falcata*, *Glycine tabacina* and *Paspalum notatum* (Pensacola Bahia grass) show promise. *Lespedeza striata* (Native) is superior to introduced selections. Nzoia, Katambora, and Commercial rhodes grasses are superior to all other grasses included in the Cinnabar trial. At Cangai only *Phalaris* and *Festuca* have shown summer survival.

PASTURE PLANT BREEDING

"Glen" cocksfoot has been mass selected for persistence, resistance to scarab grub, leafiness, and vigour, whilst retaining a temperate growth rhythm similar to Akaroa type.

Co-operative work on creeping-rooted lucerne is being conducted with the CSIRO at Yanco and Narrabri.

PLANT-ANIMAL RELATIONSHIPS WORK

A series of lucerne management trials have been started or planned for Cowra, Temora, Condobolin, Trangie, and Tamworth. One of the objectives is a study of plant reactions under various grazing systems.

At Hawkesbury Agricultural College, an investigation of pasture species suitable for prime lamb production includes a basic study of relationships between pasture attributes and animal growth and gain characteristics. Six species are being investigated. These are three winter-growers, Bacchus Marsh subterranean clover, Grasslands Manawa ryegrass, Algerian oats, and three summer-growers, Ladino white clover, Phalaris and Japanese millet. This study is being conducted under irrigation. At present, clovers appear superior to grasses in promoting prime lamb growth.

Under grazing at Kungurrabar, Siratro has proved best. Both Siratro and Lotononis persisted at Cattle Creek, Grafton.

At Taree, perennial grasses and legumes are under observation. Here *Glycine, Desmodium, Lotononis, Siratro* are the best legumes whilst Kazungula (*Setaria sphacelata*) is the best adapted grass. *Phalaris tuberosa*, Kangaroo Valley ryegrass and Cocksfoots have survived the drought to date. Lucerne (Hunter River) has performed well during the drought.

In the Hunter Valley, kikuyu and lucerne have been useful and both *Phalaris tuberosa* and Kangaroo Valley ryegrass have shown good drought resistance.

At Berry, kikuyu has proved exceptionally useful and *Setaria sphacelata* (Kazungula) appears frost-resistant. Ladino, red clover, lucerne, and *Lotus major* are the best legumes tested to date.

In the Yass Valley, Marrar subterranean clover is superior.

At Glen Innes, *Phalaris tuberosa* and *Eragrostis curvula* are showing good drought-survival.

The lucernes Hunter River and "creeping-rooted" exhibited best growth at Narrabri, Trangie, Condobolin, Cowra, and Yanco. The rose clovers Kondinon, Sirint, and Troodos, cupped clovers Yamina and Beenong, *M. rugosa* cv Paragosa, Cyprus, Barrel Medic 173, and Harbinger Medics are being tested.

Satisfactory drought survival in northern semi-arid areas has been shown for *Panicum coloratum* (Bambatsi).

The Cocksfoots GL33 and GL35 as well as the *P. tuberosa* introductions C.P.I. 19305 and 19331 show promise in southern semi-arid zones.

At Leeton in irrigated pastures various combinations of Wimmera ryegrass, *P. tuberosa*, Paspalum, Ladino clover, Bacchus Marsh, Marrar sub clover and lucerne are providing seasonal productivity studies.

ESTABLISHMENT, GROWTH, AND ECOLOGY

Establishment of perennial grasses, *Phalaris tuberosa* C.P.I. 19331 and Cocksfoots GL 33 and 35, undersown with the wheat crop is receiving attention at Temora and Condobolin. At Temora the interaction between time of sowing x seed rate x soil preparation is being examined with C.P.I. 19331 and Cocksfoot.

At Condobolin the effects of cover-cropping x seed rate on establishment with Barrel Medic 173 as well as nutritional and *Rhizobium* problems with Geraldton and Marrar subterranean clovers, Lucerne and Barrel Medic 173 are being investigated.

PLANT NUTRITION WORK

The nutritional requirements of different species are receiving attention, particularly the nutritional problems involved in legume-*Rhizobium* inter-relationships. Diagnostic and prediction services for fertilizer requirements are being developed in co-operation with the Division of Science Services.

Legumes.—At Wollongbar the nutritional needs of *Glycine Javanica* are being investigated. Related work is being conducted at Grafton with other species.

At Taree lucerne has responded to lime. Whether this is because of an increase in phosphorus availability or reduction in aluminium toxicity is not yet known.

In the Yass Valley, nodulation responses to seed inoculation have been obtained on soils developed *in situ* from sedimentary deposits. Here the "multi-step" method did not prove better than the "single step" method.

At Tamworth, the relationships and nutritional reactions between lucerne varieties and inoculum strains are being studied.

Grasses.—Several experiments are directed to the study of the economics of fertilizer nitrogen use. These include Wollongbar trials of the response of tropical grasses to different sources of nitrogen. In a grazing trial with dairy cows for butterfat production three stocking rates are being tested on kikuyu grass fertilized with high levels of nitrogen. Related investigations are in progress at Maitland, Taree, and Berry.

PREDICTION OF NUTRIENT REQUIREMENTS

Experiments are being carried out to correlate chemical analysis of soil and tissue with pasture-yield components. Soil tests for potassium and for phosphorus are being critically examined. Field experiments are located on the south coast, on three major soil types. Other research for development of diagnostic services is in progress on the north coast and in the mid-western and southwestern wheat areas.

PASTURE MANAGEMENT—PHYSIOLOGY AND ECOLOGY STUDIES

At Leeton, the importance of resting an early-watered paddock in early autumn for three weeks to permit optimal establishment of subterranean clover and Wimmera rye has been determined in "trampling" experiments.

At Trangie, individual lucerne plants are being studied to determine physiological requirements of the plant.

Earlier studies at Tamworth have shown the effects of defoliation on lucerne, pointing out that higher yields can be obtained by close cutting after adequate "spelling" of the stand.

The ecology of lucerne populations under sheep grazing is receiving attention at Trangie, Temora, Condobolin, and Cowra.

"FEED-YEAR" WORK

The "feed-year" concept is being examined in almost every region in New South Wales. The place of pastures, forage crops and supplementary feeding is being evaluated in short and long term experiments for most types of animal production.

Growth curves have been determined for kikuyu and paspalum along the coast of New South Wales. The place of sod-sown oats and self-regenerating annual clovers and ryegrasses in filling the winter feed shortage is being clarified. Refinements in establishment methods are receiving considerable attention. Summer fodder crops are finding a place in summer and autumn production in many areas, notably Hunter River and Yass Valley.

Under irrigation at Leeton, growth curves have been measured for a number of species—*Phalaris tuberosa*, Wimmera ryegrass, paspalum, Ladino white, and subterranean clovers.

Special problems, including fertilizer effects on oats sod-sown into tropical and temperate pastures, are being related to competition for such nutrients as P, S, and N.

Relationships between "feed-year" studies and animal-performance are being measured in terms of butterfat production at Wollongbar, beef production at Glen Innes and Grafton, whole-milk production at Taree, Maitland, and Berry, sheep production in the Yass Valley and at Shannon Vale, and wool production at Trangie and Shannon Vale.

Most of the experiments are devoted to clarifying concepts, testing theories and developing philosophy aimed at solving practical problems, a more complete understanding of which can directly benefit the farmer. Close co-operation is maintained with the Division of Animal Industry because of the many such interactions as animal x feed, animal variety x sex x environment x feed. The agronomist role is concerned largely with production and survival of the herbage species under different stocking rates.

Research Stations' Evaluation of Systems

Wool-Production Research.—Hitherto sheep have been carried at one per acre at Trangie, but in 1965–66 four sheep per acre were carried on a "10-paddock" lucerne trial, despite the drought. Wool production of 42 lb per acre was recorded in this pilot experiment. A feature of the pilot trial is an apparent increase in number of lucerne plants at this stocking rate.

At Condobolin, deferred and rotational grazing experiments with native and sown pastures and lucerne are being continued.

At Temora, trials are being planned to evaluate the merits of lucerne and grazing oats as a supplement to Wimmera rye-subterranean clover pastures in the wheat rotation.

At Cowra, a rotational-grazing and lucerne-supplement trial has been started.

At Narrabri, the place of summer and winter forage crops is being studied.

Sheep-Production Research.—Grain feeding for drought survival has been in progress at Shannon Vale for some time on the stocking-rate trials. *Phalaris* and perennial ryegrass have survived whilst cocksfoot has failed.

The place of forage crops in the winter-nutrition of sheep is under investigation at Leeton, Temora, and Cowra.

On irrigated pastures at Leeton an experiment comparing stocking rates, pasture types and forage crop ratios is being commenced. This is to determine effects on breeding-performance of ewes and on lamb growth.

Beef-Production Research.—At Glen Innes, a pilot trial on three farmlets is investigating the effect of no forage crop, winter forage crop, or summer forage crop, on breeder and weaner performance. These treatments are limited to definite ratios in each farmlet. The improved pastures consist of *Phalaris, Festuca, Lolium,* and clovers and lucerne.

Butterfat and Milk-Production Research.—At Wollongbar, *Glycine javanica* and kikuyu pastures have proved to be superior to native pastures, comparing spring-calved cows on existing pastures with summer-calved cows on tropical and temperate legumes. Vetch and subterranean clover have not contributed to the system as well as was thought possible, because of disease in the vetch and poor regeneration in the subterranean clover.

Spring-calved and summer-calved cows on a common legume *Glycine javanica* ("Clarence") are also being compared.

Whole-Farm Production; Pasture Economics

The Wollongbar Research team has established seven whole-farm studies, on a range of soil types, from Kyogle to Nambucca. These studies are based on planned pasture-production and utilization of sub-tropical, temperate, and native species. The factors concerned with pasture establishment, utilization, and management are being integrated.

At Taree, planning for increased winter-production is proving successful for the whole-milk industry. The feed-costs are averaging 30 per cent of gross returns.

On the south coast, fertilizer nitrogen has been shown to be economic in increasing the efficiency of production of whole-milk, and of perennial ryegrass seed.

In the Yass Valley, adaptive research on feed shortages in winter and summer has been used as a basis for planning feed supplies in relation to animal needs on four project-farms.

PASTURE EXTENSION SERVICES

Uniform Pasture Survey and Extension Trials (U.P.S.E.T.)

From the pre-packaged U.P.S.E.T. trials, surveying the occurrence of soil deficiencies and the adaptability of new pasture species, a useful body of information has been accumulated. In addition to providing guidance on species suitability and fertilizer requirements on various district soil types, the trials have served as very useful extension aids. They have been the basis of numerous field days.

A grant from the Sulphur Institute has greatly assisted in the compilation of fertilizer results for publication.

Demonstrations Under Commonwealth Grants

Some seventy-eight demonstrations are being conducted by using funds from the Commonwealth Dairy Industry Extension Services Grant, and eight with funds from the Commonwealth Agricultural Extension Grant.

Ryegrass "cultivar" demonstrations and trials have been established in appropriate regions of New South Wales.

Trials to show the range of annual dryland pasture legumes for use in low-rainfall marginal-farming areas have been laid down.

PASTURE SEED INDUSTRY

Production Affected by Drought

As a result of drought the total of pasture seed certified in 1965–66 dropped to 41 per cent of the previous year's record production. The total was 1,040.8 tons this season, as against 2,550.5 tons in 1964–65. The reduction in amount of uncertified seed was probably greater.

The harvest of the main species comprised Subterranean clover 919.8 tons, *Phalaris tuberosa* 50.2 tons, Kangaroo Valley ryegrass 69.9 tons, and 0.9 tons of New South Wales ryegrass.

Relativities of the main varieties of subterranean clover remained almost unchanged. Mount Barker accounted for over 50 per cent of the amount certified; followed by Dwalganup and Marrar. The amount of Tallarook certified decreased, while Bacchus Marsh and Clare increased. A small quantity of Howard was certified for the first time.

Foundation seed of Seedmaster *Phalaris tuberosa* was supplied to twelve growers. They undertook to produce mother-grade seed under isolation and row-culture conditions. Only one of these growers produced a worthwhile quantity of seed, but he provided a notable example of what can be done. At Cowra, he sowed 20 lb of foundation seed on 24 acres and produced over 10,000 lb of cleaned seed in this first year. This has enabled extensive areas to be sown to produce certified seed next season.

Production of Kangaroo Valley ryegrass declined by 15 per cent. Most tableland crops of perennial ryegrass were failures.

A number of growers failed to control weed growth in cocksfoot crops, and cleaning the seed has been difficult and prolonged.

New Certification Schemes

Certification of seed of two varieties of cocksfoot, Brignoles and Currie, has now been introduced.

A new *Phalaris* variety, Seedmaster, was included in the *Phalaris tuberosa* certification scheme.

Development of a Specialized Pasture-seed Industry

A number of farmers have bought properties with irrigation facilities and land suitable for row-cropping, to make grass-seed production their major activity. Others have increased their areas of seed crops and a few have installed drying machinery to condition seed after harvest.

The trend has been stimulated by the high yields of seed obtained by a few growers who have given serious attention to seed crops. Yields of 600 lb of clean seed per acre have been obtained from crops of perennial ryegrass, cocksfoot, and tall fescue, and of over 400 lb from a first-year crop of Seedmaster Phalaris.

Inspections under Various Acts

Three inspectors maintained inspections throughout the State under the Agricultural Seeds Act, Stock Foods and Medicines Act, Pest Destroyers Act, Fertilizers Act, and Veterinary Surgeons Act. Practically the whole time of one inspector was taken up by investigations under the Veterinary Surgeons Act and the Stock Foods and Medicines Act.

The inspectors visited 152 towns, inspected 613 stores, and found 729 unregistered products. Three prosecutions were conducted under the Agricultural Seeds Act.

The inspectors also continued to sample and seal all certified seed cleaned in the metropolitan area. This includes beans and maize, as well as pasture seeds. They also resealed seed lots from other States and from New Zealand when these had to be repacked in special ways for export.

SEED TESTING LABORATORY

The work volume as measured by number of samples decreased by 8.7 per cent in comparison with the 1964–65 season, due mainly to drought in seed-growing areas. Of the 3,139 samples received in the Laboratory, approximately 750 were examined under Quarantine Regulations and 910 for certification tests. The number of certified pasture-seed samples was reduced by about 36 per cent.

Cereals Work

CEREAL COMMITTEES AND CONFERENCES

The Cereal Specialist served in numerous committees. Among these were the N.S.W. Departmental Wheat Executive, N.S.W. Standing Advisory Committee on Wheat, N.S.W. F.A.Q Committee, State Wheat Improvement Committee, and Reserve Review Committee (Wheat Plant Nutrition) He was also secretary of the N.S.W. Advisory Committee on Wheat Production and Marketing. Other conferences attended were those dealing with "Central Western Wheat Nutrition" (at Parkes and Head Office), "Premium Wheat Quality", and "Fertilizer Experiments".

TABULATION OF PASTURE SEED CERTIFICATION, 1965–66

	Sub. Clover	Phalaris	K.V. Ryegrass	N.S.W. Ryegrass	Cocksfoot	White Clover	Barrel Medic	Totals	
								1965-66	1964-65
Areas Registered	364	153	48	16	75	3	1	660	641
Acres Registered	40,789	9,966	1,518	771	2,478	35	70	55,727	62,679
Acres Passed	25,248	3,990	1,037	304	1,522	..	..	32,101	40,606
Acres Rejected	1,790	186	70	..	50	..	..	2,096	4,207
Acres Withdrawn	13,751	5,784	419	467	1,006	35	70	21,532	17,866
Bags Paddock-Sealed	18,702	2,131	3,610	439	1,326	..	..	26,208	55,044
Lines Sampled and Tested	239	121	153	12	40	..	..	565	793
Recleaned Lines Tested	15	13	38	1	10	..	..	77	85
Tons Finally Sealed	919·8	50·2	69·9	0·9	..	..	..	1,040·8	2,550·5

FIRST AUSTRALIAN CEREAL AGRONOMY CONFERENCE

The Cereal Specialist, as Departmental representative in the Committee, attended the Conference in Melbourne and at Horsham, Victoria. He (Mr Walkden Brown) and the Assistant Cereals Specialist (Mr Fitzsimmons) prepared papers for the Conference, and Mr Walkden Brown acted as Review and Discussion Leader or as Chairman for several of the Conference sessions. A Conference Report has been circulated.

WHEAT

The Season.—In northern areas rainfall was below average for every month, except December. In central areas only October and December had average or above average rainfall. In southern areas average or above average rainfall was received in only four months.

Even where crops were sown and established, the advent of hot dry winds in the spring, coupled with inadequate falls of rain and lack of pasture for stock, forced many farmers, particularly in the north, to graze off their crops. Crops on heavy soils and in soils with high nitrogen content hayed off quickly because of the severe moisture stress.

Hot dry winds in late September and October caused severe drought tipping of emerging ears. The damage was difficult to distinguish from that due to frost. Both severely deprived the developing grain of moisture.

Acreage and Production.—In the northwest only about 10 per cent of the acreage was sown, as compared with previous year's total. In central areas the acreage was down by about 50 per cent. In the south, where the drought was least felt, sowings were only about 20 per cent less than in the previous season.

The crop was the smallest since 1957–58. Total grain production was estimated at 39,000,000 bushels, from 2,600,000 acres, at an average of 15.0 bushels per acre. The total area sown for all purposes was estimated at 4,200,000 acres; the greater part cut for hay or grazed out because of feed-shortage and the poor prospects for a grain harvest. Best crops were in the south, in the eastern corner of the wheat belt.

Harvesting was virtually completed by mid-January. Deliveries to the Wheat Board in N.S.W. totalled 27,370,000 bushels; 27,054,000 bushels in bulk (99 per cent) and 316,000 bagged. Of the total, 1,971,000 bushels received a premium and 590,000 bushels was classed as off-grade.

Also, some wheat was delivered to the Wheat Board in Victoria from southern stations operated by the Victorian Railways. The rest of the estimated 39,000,000 bushels harvested is held on farms for seed or feed, or for later delivery to the Wheat Board.

Premium Wheats.—Premium payments totalled $661,186, on 1,970,598 bushels; as against $913,386, on 4,401,790 bushels, in the previous year. Most of the 1965–66 wheat crop premium payments were for hard bread-wheat varieties—1,131,745 bushels.

The premium average for hard-wheat varieties was 53.635c per bushel (31.35d. in 1964), and for soft varieties it was 6.458c (4.76d. in 1964). The highest premium bids for individual parcels were 105c for Mendos and Gamenya, 103.333c for Spica, 102.5c for Mengavi, and 101.667c for Koda. Mendos gained the highest premium-average, 100.048c; with Kenora next (78.695c), and then Spica (76.023c).

Gauged by premium-acceptance quantities the most popular hard-wheat varieties were Falcon (26.69 per cent), Gamenya (19.95 per cent), Mendos (15.71 per cent), Spica (11.91 per cent), and Mengavi (10.95 per cent). Those five varieties totalled 85 per cent of the hard-wheat premium deliveries.

Pinnacle (558,391 bushels) and Heron (116,066 bushels) accounted for over 80 per cent of the soft-variety deliveries for which local premiums were paid. Highest premium-bid for an individual soft-wheat parcel was 76.667c for Heron.

F.a.q. Standard.—Only one standard was declared—for southern and western wheat combined, as little wheat was received from the northern areas. This year's standard was declared at 63 lb per bushel schopper-weight. General appearance and cleanliness of this year's f.a.q. sample were good. Mixture of hard and soft grains was noticeable.

Variety Popularities.—Major changes have occurred in the popularities. This reflects appreciation of the greater productivity of new varieties. The latest figures available are for the 1964 plantings.

Heron occupied first position in 1964, with 19.8 per cent of the total acreage. With 14.3 per cent it was also in first position in 1963. Falcon showed in 1964 a rapid rise in popularity, rising to second from its fifth place in the previous season. Olympic retained third place and increased slightly in percentage area. Gamenya rose from fifth to fourth position and is now the most popular variety in the northwest. Bencubbin, Gabo, and Glenwari, formerly most popular varieties, continued to recede in percentage area.

The 1964–65 statistics show decline in popularity of Mengavi, Glenwari, Bencubbin, Bordan, Festival, Gabo, Eureka, Warigo, Koda, Sabre, Spica, and Winglen and Windebri (combined), but increased popularity for Heron, Falcon, Insignia, Gamenya, Olympic, and Pinnacle.

Variety Recommendations.—Only minor changes in wheat variety recommendations were made for the 1965–66 season.

Mendos was added to mid-late sowing recommendations for rust-liable areas in the western section of the Western Region. It is resistant to all the prevalent strains of stem rust, yields similarly to Mengavi and resembles Gabo in milling and baking quality.

Mengavi was deleted in favour of Mendos in irrigated areas. Thus, now susceptible to several of the prevalent races of stem rust, Mengavi is no longer recommended in any Region.

Pinnacle was added to early-sowing recommendations in the Southern Region and the tablelands portion of the South Coast and Tablelands Region. It has short, strong straw and yields well, particularly when sown early after an improved pasture phase in reliable rainfall areas.

A farmer-service leaflet was prepared for the Southern Region, describing the recommended varieties in detail. This was to help farmer-selection of varieties best suited to the farm concerned. The material was forwarded to the Printery before the 1965 harvest, but unfortunately the leaflet has not yet been printed and the 1966 sowing has now been completed.

Winter Wheats.—Winglen and Windebri, two winter wheats bred by the Department, continued to be grown on a significant area, especially in the north. In 1964–65 they occupied 130,455 acres. Their acreage was less in 1965–66, only because of the drought, and in fact no seed of Winglen or Windebri was bought for a premium, whereas 200,000 bushels was so bought in 1964–65.

Early sowings, made in more favourable localities or under irrigation, produced good winter-grazing.

Overall, the acreage of winter wheats has not expanded significantly in recent years. This is mainly because of their late maturity, their moderate yield, and their susceptibility to prevalent strains of stem rust.

Durum Wheats.—Because of the drought, little durum wheat was sown in 1965. In the previous year, 72,193 bushels of Dural were harvested from an area of 4,685 acres.

Demand for durum products is increasing and this should continue. The most important limitation on durum acreage is the relatively low yield and late maturity of Dural, compared with the northwestern standard bread-wheat varieties. But breeding for higher yielding and early-maturing durum varieties is proceeding at Tamworth Research Station.

Because of seed shortage and the unfavourable outlook at the start of this sowing season, a milling firm arranged for the building up of seed supplies in the south under irrigation.

Wheat Quality.—Chemistry Branch, Division of Science Services, co-operated in quality-testing of new varieties under yield-test. Because of drought, fewer samples than usual were available; about 300, compared with 700 in 1964. Also, uniform quality-testing of two promising crossbreds being considered for release or recommendation was done by collaborating laboratories.

The Cereal Specialist judged the bench characters of wheats in the open classes at the 1966 Sydney Royal Show. Entries totalled only 48, compared with 78 in the previous year. The highest bushel-weight was 67 lb, for a sample of Festiguay and three samples of Heron. The best varieties per class were Festiguay, Falcon, and Heron—all bred by the Department.

Entry totals, as indicators of popularity, were: Olympic, 13; Falcon, 10; Festiguay, 4; Heron, Mendos, and Gamenya, 3 each; and Bordan, Sabre, Stockade, and Spica, 1 each.

Wheat Variety Trials and Performances.—Randomized and replicated variety trials were conducted with 66 (65 in 1964–65) farmers, working under the supervision of 20 (19) district agronomists, testing 16 (22) varieties. Variety trials were conducted, also, on six Research Stations, comparing a large number of promising crossbreds and new varieties with standard varieties.

New varieties tested included Festiguay, Mendos, and the unnamed crossbreds KF Heron and TR118 (now named Gamut).

Because of the drought many of the wheat variety trials failed. In the north only one trial was harvested and in this the yield variability made the results valueless. In central and southern areas only 55 trials were harvested, compared with 89 in the previous season.

In the central and southern areas the dry season favoured early-maturing varieties. Heron was the outstanding standard variety, followed by Gamenya, and then Olympic and Falcon about equal. Despite fairly early maturity, Falcon did not do as well as expected. Frost or drought, or both, affected it at a critical stage.

Festiguay and Mendos did very poorly in central and southern areas. Since their performance in previous years was also poor they have been rejected from further trial, except in the north or under irrigation.

KF Heron again showed considerable promise. It again outyielded Heron, although the margin was not as wide as in previous years.

Gamut (TR118) performed poorly in central and southern areas; very inferior to Heron and Gamenya and about equal to Falcon, Mengavi and Mendos. It does not appear that Gamut will be useful in central and southern areas, except under irrigation.

Soil Fertility and Rotation Experiment.—This experiment at Condobolin Research Station has now completed its tenth year.

The season was not favourable for cereal or winter-pasture production because of lack of moisture at germination and in early-growth stages. But after heavy storms in spring and early summer there was good grazing from regenerated cereals and lucerne. Barley grass infested most plots and was worse in sown pasture plots. Skeleton weed became firmly established throughout the trial. It gave considerable grazing, especially in fallow plots during the summer.

The best grazing was in the lucerne plots. Next, in order, were Barrel medic, Wimmera ryegrass plots, and then grazing oats and native pasture.

Wheat yields varied from 1.4 to 10.8 bushels per acre. As expected, the yield average of plots after long fallow was better than that for medium and short fallow. Bushel-weights varied from 48.0 to 56.0. Oat yields varied from 1.9 to 3.6 bushels per acre, and bushel-weight from 19.5 to 29.0.

Other Rotation Experiments.—The trial at Trangie Research Station comparing volunteer and sown pasture and their effect on wheat yields was concluded. It yielded useful information about stocking rates under the various management practices and types of pasture.

Wheat Fertilizer Trials.—In the north the fertilizer trials could not be sustained in the severe drought. But all of the analyses for the previous three years have been completed and the results have been written up for publication. An encouraging effect of the work has been the northern farmers' keen interest in soil phosphate analysis and in higher levels of superphosphate application to wheat crops.

In the central west the second year of wheat fertilizer trials has been completed. Because of drought, only 14 of the 43 trials sown were worth harvesting. But despite the low yields in the 14 trials, the work has been so precise that the results have been valuable. They indicate that in a district where yields average, say, 12 bushels per acre, 1 cwt superphosphate per acre is about the optimum on low-phosphate soils.

As in the northwest, this research and subsequent extension work are inducing farmers to apply greater quantities of superphosphate.

Wheat fertilizer trials have now been extended to the eastern part of the central west, by the appointment of a research agronomist to the Cowra Station.

Some fertilizer and seed-rate trials were continued by District agronomists in irrigation areas. These indicate that higher seed and fertilizer rates can give higher yields, but the results have varied and no specific recommendation can be made as yet. Full development of this work awaits the appointment of a research agronomist for full time attention to it.

Field Wheat-Competitions.—Only five Divisional Championships were conducted by the Royal Agricultural Society of N.S.W. Entries in the Northern Division were insufficient to justify championship judgings there.

Most of the local and all the championship judgings were done by officers of this Department. The crops judged totalled 295, in 31 local competitions; compared with 859 crops, in 80 local competitions in 1964.

The champion in Northern Slopes Division was a Festiguay crop (28 bushels/acre), in Western Division a Falcon crop (27), in Central Slopes Division a Falcon crop (39), in Riverina Division an Olympic crop (40), and in Southern Slopes Division a Bordan crop (53).

OATS

Production.—In 1964–65 a near-record crop of oats was harvested; 22,885,000 bushels from 850,000 acres sown for grain (26.9 bushels per acre). Hay production was 102,953 tons from 66,000 acres at a yield average of 1.56 tons per acre. About 44 per cent of the total area was used for grazing only. The total area sown in 1964–65 was 1,635,000 acres.

By contrast, in 1965–66 the estimated grain yield was only 11,000,000 bushels, about 50 per cent reduction. The estimate of area harvested for grain is 560,000 acres (yield average of 19.6 bushels per acre). Hay production was estimated at 115,000 tons, from an area of 95,000 acres.

Much of the crop in 1965–66 had to be sown into a dry seedbed. Rain in late August and early September improved prospects in southern districts but hot dry winds late in September caused deterioration. The rains came too late for northern crops and for most crops in central areas.

Variety Recommendations.—Bundy, a new variety bred at Glen Innes Research Station, was added to several Regions —mainly northern—to replace Belar and some other varieties. The main advantages of Bundy are its strong straw, smut-resistance, and good yields—for lenient grazing and grain, and grain only.

Burke and Ballidu have been rejected for all Regions, because of general inferiority to the newer varieties Avon, Fulmark, Orient, and Bundy.

Variety Popularities.—Figures for the 1964–65 season showed changes in popularities. Belar, most popular for many years, had fallen from 52.8 per cent of the oat acreage in 1954–55 to 18.1 per cent of it in 1964–65.

Cooba showed the most spectacular increase. It rose from sixth place (4.6 per cent) in 1963–64 to second place in 1964–65 with 14.6 per cent of the total area. Cooba is very popular as a dual purpose variety in central and southern areas.

Avon, which showed a similarly spectacular gain in 1963–64, receded a little and had third position in 1964–65.

Fulghum, maintaining a fairly steady acreage in recent years, retained fifth position. Dale, Orient, Acacia, and Ballidu all declined slightly in percentage of area.

Variety Trials and Performances.—Fewer oat trials than usual were harvested in 1965–66, because of the drought. Also, less grazings were made and grain yields were lower.

In the north only four trials were successful, all at Glen Innes and Grafton Research Stations. In central and southern areas, only 17 trials were harvested; as against 43 in the previous season.

For grain only, Avon was the outstanding of the standard varieties. It was followed by Fulmark and Orient (about equal) and then Cooba. For grain-recovery, Cooba was the best. It was followed by Avon and then Fulmark and Orient about equal. For grazing cuts, Cooba was the best. It was followed by Fulmark and then Avon and Orient about equal. When sown early, Cooba is usually better than Fulghum for grazing cuts. But for early grazing and for total grazing when sown late, Fulghum is usually superior to Cooba.

Bundy, named in 1964, proved to be quite versatile. For lenient grazing and grain it has proved equal to or better than most of the standard varieties.

As the old varieties Burke and Ballidu have been generally inferior to the newer standard varieties, over a large number of trials, they have been rejected from recommendations and from further trials.

Oat Improvement Programme in the North.—The breeding programme, headquartered at Glen Innes, has lapsed since in December, 1964, the oat breeder was transferred to other duties. Breeding is in abeyance until another breeder is appointed.

The Glen Innes winter was mostly dry and resulted in fewer grazing cuts than usual. The trials were also sown later than was desired. In consequence, varieties with a tendency to produce early grazing, such as Fulghum, gave better results than those tending to later grazing, such as Cooba and Klein 69B. Several lines from the cross (Fulghum x Garry) x (V.R.A.F. x V.R.S.F.) performed well in comparison with standard varieties.

The name Mugga was this year given to the hybrid V.R. Boppy. Belar (W4606) bred at Glen Innes Research Station. Mugga is designed to replace Algerian on the northern tablelands and on the Coonabarabran plateau. It is superior to Algerian for straw-strength and in resistance to frost damage after grazing. It resists smut and is tolerant to barley yellow dwarf, but susceptible to stem and crown rust.

Bundy, a mid-season maturing variety released in the previous year has shown a wide adaptability for lenient grazing and grain, and for grain only, throughout the State. There has been keen demand for its seed. It seems likely to be a popular variety within a few years.

Rate-of-Seed and Fertilizer Experiment, Grazing Oats.—The effects of nitrogenous fertilizer on production of green fodder and on grain recovery of oats, at two different times of fertilizer application and at two sowing rates, were tested at Glen Innes Research Station. A basal application of 1 cwt superphosphate per acre was applied.

Because of the dry season only three grazings were obtained in the early-sown trial and two grazings in the late-sown trial. No significant difference was obtained by sulphate of ammonia application in April or August, in grazing or grain yields, in the early-sown trial or the late-sown trial. Similarly, seeding rate had no effect. It seemed that nitrogenous fertilizers and increased seeding rates do not produce significant responses in a dry season.

BARLEY

Production.—Growers maintained their interest in barley, for feed grain and for malting. Barley-growing for grain has expanded rapidly since 1957–58. In 1964–65 record acreage and record production were achieved. Barley sowings for all purposes totalled 273,799 acres; comprising 34,093 acres for green-fodder production, and 238,983 acres harvested for a grain yield of 6,707,100 bushels. Of the total yield 4,040,460 bushels were of 2-row grain and 2,666,646 bushels of 6-row grain. Hay production was 1,037 tons from 723 acres.

Previous record barley-production was in 1962–63, when 5,361,000 bushels were harvested from 221,000 acres in the total of 254,000 sown for all purposes.

Although figures are not yet available, it is known that barley production in 1965 suffered severely as a result of the drought.

Barley Variety Trials and Performances.—Grain-yield performance and agronomic aspects of new and established barley varieties were compared in trials at Research Stations and on farmers' properties. Randomized and replicated variety trials were conducted (previous year's figures in brackets) with 15 (18) farmers, working under the supervision of 12 (14) District agronomists, testing a total of 10 (10) varieties. Also, trials were conducted at one Research Station. Because of the drought, four trials were not harvested.

The season favoured the earlier-maturing varieties. Maltworthy and Beecher gave the best results overall. But despite its fairly late maturity, Abyssinian yielded quite well and proved it is adaptable to a wide range of conditions. Proctor, latest maturing of the varieties in the trials, yielded poorly.

CEREAL RYE

Production.—Latest available production statistics are for the 1964–65 season, when 72,552 bushels of grain were harvested from 4,188 acres (17.3 bushels per acre), in a total of 8,704 acres for all purposes—including green-fodder production. Although grain production was higher than for some years past, it was small compared with the record of 193,000 bushels in 1939–40 from 12,196 acres.

Increased interest in 1964–65 is thought to have been a result of an offer by a milling firm—a guaranteed price for grain contracted from the crop in that year. A similar offer was made for rye from the 1965–66 crop.

The 1965–66 acreage sown to rye is expected to be lower than for the previous year, because of the drought. But in many areas it was noted that rye withstood the dry conditions better than the other cereals.

Basic Seed Stocks Maintained.—The Department maintained basic seed stocks of the varieties Weethalle and Strain 8, and distributed seed of each to co-operating farmers for seed-increase and general distribution.

WHEAT, OATS, BARLEY, RYE GRAZING TRIAL

At Cowra Research Station, the trial comparing the green-fodder production of varieties of wheat, oats, barley, and rye failed because of the drought. By contrast, in the previous season eight cuts were made.

Over the period of this trial, oats have produced the greatest overall yield of green matter.

WHEAT, OATS, BARLEY PURE-SEED PRODUCTION

Supplies of pure seed of recommended and promising varieties of wheat, oats, and barley were maintained on eight Research Stations and distributed through Registered Seed Growers located throughout the State. In 1965–66 foundation seed sowings on Research Stations totalled (previous year's figures in brackets) 62 (89) acres of wheat, 34 (57) acres of oats, and 20 (20) acres of barley. Also, and associated with the pure-seed production-schemes on Research Stations, initial selection and preliminary increase of wheat and oats were conducted at Temora Research Station and, of barley, at Wagga Agricultural College.

A total of 245 Registered growers in 1965–66 participated in the Registered Cereal Seed Scheme with the Department and disposed of large quantities of pure seed to other growers.

In all (previous year's figures in brackets), 139 (132) Registered Seed-wheat growers working under the supervision of 22 (22) District agronomists throughout the wheat belt, using foundation seed supplied by this Department, undertook seed-increase of 13 (16) wheat varieties; 93 (92) Registered Seed-oat growers in 23 (23) District agronomists' areas carried out seed-increase of 15 (14) oat varieties; and 22 (28) Registered Seed barley growers undertook pure-seed production of 7 (7) barley varieties in 13 (18) District agronomists' areas.

However, because of the drought, many of the seed areas, especially in the north, failed to produce a harvest.

MAIZE

Production and Trends.—The value of the maize crop was enhanced by drought. The acreage was expanded in inland irrigation areas and because of enhanced appreciation of the grain for supplementary feeding on coastal dairy farms. The grain was in high demand for stock-feeding and for manufacturing. Prices ruling were the best for years. Manufacturers of breakfast foods and starches received Commonwealth approval to import maize, the first for six years.

Individual farm-acreages of 300–400 acres of irrigated maize was a new development in inland areas. The total area harvested for grain was estimated at 60,000 acres, 15 per cent more than the average harvested-area for the previous four seasons. The dry conditions minimized disease and facilitated harvesting. Estimated yield for the season was 2½ million bushels, the highest for six seasons.

Heatwaves, depletion of irrigation streams, and zinc-deficiency on newly-developed irrigation soils, caused pollen-blasting and disappointing yields from some crops. But yields of 150–200 bushels per acre from other crops enhanced the reputation of hybrids. These yields also proved the capabilities of fertile soils to carry in the vicinity of 20,000 plants per acre where irrigation is adequate.

Interest in use of nitrogen was maintained. Contract-application of nitrogen as anhydrous ammonia and aqua ammonia, and the availability of high-analysis fertilizers, encouraged their use. But in many instances this was trial-usage.

Importance of fallowing, soil fertility, and crop-rotation were emphasized by yields of 150–200 bushels per acre—obtained after a pasture phase, without applied nitrogen.

Use of waxy-maize starch by canners became more general. Acreages of waxy-maize hybrid N.E.H.1215wx sown under contract to a starch manufacturer were doubled, and seed production of the hybrid was increased.

Acreage of maize harvested and threshed direct from the field increased to about 25 per cent of the total. Artificial drying and bulk handling were stimulated accordingly.

Hybrid Maize Improvement Programme.—Inbred lines for incorporation into the breeding programmes were introduced from India, Morocco, and U.S.A. and handled under quarantine at Leeton Agricultural Research Station.

Improvement programmes at Glen Innes and Grafton Agricultural Research Stations were curtailed by the dry conditions.

At Grafton, less than half of the planned sowing for improvement of late-maturing hybrids were possible. Leaf blight (*Helminthosporium turcicum*) was inhibited in the breeding nursery, and this year in the programme was lost because of inability to select for resistance.

Open-pollinated ear-selections collected for inclusion in the progeny test totalled 125, but their sowing was withheld.

Only 36 of the 91 selections representing various levels of inbreeding were sown, and, from these, there are three new fixed-inbreds for naming.

Backcrossing programmes involving the inbreds D21 and C103A were commenced, to improve husk-covering.

Yellow-endosperm fixed-inbreds totalling 133 were maintained, involving 3,314 completed hand-pollinations. But poor sets, due to dry weather, limited their production of seed.

Lack of irrigation at Grafton Agricultural Research Station limited to 50 per cent of normal the seed-production of experimental hybrids, and prevented the production of single-crosses in the hand-crossing block.

The planned testing of 49 mid-season and 49 late-season double-cross hybrids was abandoned.

Irrigation helped in the development and testing of most of the early-maturing hybrids at Glen Innes. Sixty new double-cross, early-maturity hybrids, and 16 new double-cross, very early maturing hybrids were made up for testing. Yield superiority in four of the very early maturing hybrids was notable.

Inbred selection and maintenance were undertaken. Inbreds NE1, NE2, and NE3 developed from second-cycle material continued to show promise.

Selection to rectify defects with promising inbreds C103, B15, and OH56 continued. The improved line C103A was used in hybrid pedigrees.

About 1,000 bushels of seed of the latest released hybrid, N.E.H.1151 (C103 x B15) (H10 x 701), were produced for commercial growing. The hybrid's satisfactory field performance was evident by one area winning the Championship Field Maize Competition for the South Coast Division and another being placed second in the North Coast Division.

Interest in use of the Department's waxy-maize hybrid N.E.H.1215wx was stimulated by commercial production of 30,000 bushels of grain for processing. Processed waxy-starch was used in the canning industry. Field performance of the waxy hybrid included an area of it winning the Inland Field Maize Championship. Its assessed yield was 210 bushels per acre.

A full range of inbred and single-cross maize lines was supplied to the Department of Primary Industries, Queensland, to assist the breeding programme there. Three inbreds developed by the Queensland Department at Kairi Research Station were included in the late-maturing hybrid programme at Grafton, but seasonal conditions prevented the intended observations.

Male-Sterility Programme.—Commercial seed-production of the early-maturing hybrid N.E.H.7 and the late-maturing hybrid G.H.128 with male-sterile material was successfully undertaken. Stocks of male-sterile and restorer foundation-seed lines were reasonably built for the continued certified seed-production of these hybrids by the male-sterile method.

Selection for tassel-fertility of the 30 inbreds at various stages of conversion was made difficult by dry weather at Grafton Agricultural Research Station, but grain-setting was mostly adequate. Eighteen of the 30 inbreds in the conversion programme were taken beyond the fifth backcrossing stage.

Male-sterile and non-restorer forms of inbred 13 were isolated, for possible seed-production of hybrid G.M.211 by the male-sterile method.

Seed stocks of inbreds Y1MS and 21MS were produced in isolation, while inbreds C121MS, FF1MS, M1MS, Y1MS, 13BMS, 21MS, 23MS, 25MS, 61AMS, 68MS, C17R, 23R, and 25R were sown in a hand-pollination nursery.

Leading inbreds 25 and 23 continued to prove difficult, particularly in the restorer forms, because of variability in tassel-fertility. This was of concern to the breeding programme and to certified seed-production. Testing of the inbreds in the CSIRO phytotron at Canberra indicated that environmental conditions had little bearing on their peculiar field behaviour.

Setting of grain was faulty in some G.H.128 seed crops where 25R x 23R was used as the pollinating parent for the first time and this required investigation. Heatwave conditions at the pollinating stage seemed responsible.

A programme to remove the cytoplasmic male-sterility factor by crossing 25NR line with 25R line as the pollinator and recovering the homozygous restorer line followed selfing, by use of a test cross with a male-sterile tester, was taken a step further in the Grafton programme.

Hybrids Resistant to Leaf Blight.—Commercial maize areas were free of loss from leaf blight (*Helminthosporium turcicum*) in the dry summer conditions.

Glen Innes and Grafton Agricultural Research Stations continued their breeding for blight resistance. Emphasis was on development of blight-resistant early-maturing hybrids, and F2 progenies of crosses between early-maturing and late-maturing blight-resistant inbreds were grown at Grafton Station for a further generation of selfing and selection for resistance. However, efforts to induce the disease were unsuccessful, due to drought, and a year in the programme was lost.

Twenty-two crosses of susceptible early-maturing lines with the American line "Source B" containing the dominant single gene for blight-resistance were sown. This was to determine the effectiveness of the resistant gene. But absence of blight made assessments impossible.

Hybrid Maize Trials.—Twelve trials with late-maturing hybrids and 14 with early-maturing hybrids were conducted with commercial and experimental hybrids. Results were expected from less than half of them, because of drought. There were variations in the performance of hybrids due to seasonal conditions and maturity factors, but G.M.211, G.H.128, and G.H.134 in the mid-season late-maturing group continued to show yield superiority. Also DeKalb hybrids D.S.606A, D.S.601, D.S.28 and Departmental hybrids N.E.H.1151, N.E.H.7, N.E.H.1215wx, and N.E.S.1002 in the early-maturing group did well.

The trials indicated that all commercially-released hybrids had high yielding ability not being fully utilized by most maize growers. Soil fertility, low plant-populations and inadequate fertilizer use reduced yields of many commercial crops.

More emphasis was placed on the standing ability of hybrids because of the increasing tendency to harvest and thresh in the field. Mid-season and late-maturing hybrids used commercially showed good standing ability. The latest released hybrid, N.E.H.1151, also impressed in this regard.

Use of a pasture rotation, plant populations of 18,000 and better to the acre, with applied fertilizer in most instances, resulted in some irrigation crops yielding 150–200 bushels per acre.

Because of the almost complete absence of rain in the growing period, 21–25 in of applied water were needed for satisfactory irrigated crops. The need of adequate moisture until grain reached the soft-dough or early-dent stage was shown. Some crops failed to finish satisfactorily where irrigation was inadequate in the late-growth stages.

New areas of black self-mulching, high-alkaline soils in the northwest revealed a zinc deficiency. It was severe in some cases. Investigations as to the best practical means of rectifying it were started.

Advice on actual rates of nitrogen for a maize crop was not possible from trial results. It was again shown that soil fertility and moisture availability were the main factors determining economic nitrogen-response. Little yield-response was obtained in one trial on high-fertility soil, from as much as 80 lb of applied nitrogen. But there was a 25–30 per cent increase on soil of low or medium-fertility.

The highest assessed yield for maize was 210 bushels. This was on alluvial soil previously under pasture for 10 years and with only 1 cwt superphosphate applied at sowing.

Hybrid-Maize Seed Certification.—Hybrid-maize seed certification details were as follow:

Hybrid type	Growers	Acres	Prodn. (Bus.)	Yield Average (Bus./acre)
Early	7	35	1,065	30·4
Mid-season	15	49	2,016	41·1
Late	31	335	11,083	33·0
Totals	53	419	14,164	33·8

Seed certified totalled about 4,000 bushels less than in the previous season, but 4,332 bushels carried over helped to meet the increased demand. Limited foundation-seed supply restricted the seed acreages of some hybrids.

Seed certified was sold freely to all States. Queensland demand for hybrids G.H.128 and G.M.211 was maintained.

Hybrid G.H.128 comprised 72 per cent of the total seed certified, and this hybrid occupied about 90 per cent of the area sown for grain on the north coast. Seed-production costs for hybrid G.H.128 were reduced by complete changeover to use of male-sterile lines.

Foundation-seed for production of the recently released hybrid N.E.H.1151 was increased, and production of certified seed was doubled to about 1,200 bushels.

Production of certified hybrid-maize seed was controlled to some extent by the Hybrid-Maize Seed Co-operative. This controlled the activities of member-growers by allocating areas and distributing foundation-seed. Co-operative members produced 50 per cent of the total seed certified. There was no firm seed-grower control on prices, but prices paid by commercial growers remained unchanged.

In keeping with the change to decimal currency, all seed certified was packed in 50-lb sacks in lieu of the previous 56-lb bushel pack.

Arrangements also were made to certify seed packed in good quality 11-oz reinforced seam sack, instead of the double sack as previously required.

SWEET CORN

Acreage and Production.—The area sown to hybrid sweet corn for canneries was doubled, to an estimated total of 3,000 acres. Areas were sown at Tumut and Gundagai for Batlow Cannery; at Windsor and Richmond for Rosella and IXL; and at Bathurst, Mudgee, and Cowra for Edgells. Picts had small areas in the Tabulam-Glen Innes sectors for quick-freeze purposes.

There were seed germination difficulties with some early sowings, but the crop generally was good. Disease and weed-growth were at a minimum. Yields generally from 4–6 tons per acre were obtained with irrigation.

Hybrid Iochief occupied must of the acreage sown for canning purposes. One cannery used a small area for a new hybrid, Golden Sensation.

All crops utilized by canners were sown under contract. Prices of about $30 net per ton were realized by growers.

Introduction and Improvement Programme.—American sweet corn inbreds were introduced and used at Glen Innes Agricultural Research Station for development of improved hybrids. But no hybrid with the all-round characteristics of Iochief has resulted.

There were synchronization difficulties in seed-production of hybrid Iochief. Inbred lines I5125 and I453 with better synchronization were selected at the Glen Innes Agricultural Research Station and made available for seed production. The genetic striping-effect causing concern in the inbred I5125 was also reduced by selection.

Hybrid-Seed Certification.—Twenty-eight acres of hybrid sweet corn were registered for certification. The total comprised 18 acres of Iochief and 10 acres of Golden Cross Bantam. Estimated production was 500 bushels and 200 bushels, respectively.

Seed of Golden Cross Bantam was produced and certified under certification, mainly for Victorian growers' use and the packet trade.

POPCORN

Acreage Yield, and Market Trends.—About 1,000 acres of hybrid popcorn were sown under contract to processors. A small area at Mudgee with irrigation was estimated to yield 100 bushels per acre.

Local sales of popcorn were stimulated by greater publicity, by marketing of new confectionery-packs, and by sale of grain for home-popping. Some unpopped material was exported by a firm and this firm was also active in supplying city-based popping-machines.

Improvement Work.—Glen Innes Agricultural Research Station produced seed of hybrid N.E.P.37 by the male-sterile method. This Station also selected inbreds for strength of stalk and a minimum of suckering. Inbreds SA1490–3, SAA106, SG18, and AP5 showed most promise.

GRAIN SORGHUM

Acreage and Production.—For the second year in succession there was a poor harvest, due to drought. The sown area, over 100,000 acres, was a record, but the estimated 700,000 bushels harvest, although double that of the previous year, was only about 50 per cent of normal. The main sowing areas were the northwest and the Berrigan-Finley districts. But central western areas paid more than previous attention to the crop.

Interest was stimulated in use of the crop on fallowed soils not sown to wheat because of the winter-drought. About 75 per cent of the dryland sowings in the northwest did not produce grain but provided valuable grazing, and areas were again baled for hay.

The area under irrigation increased to about 6,000 acres and top yields under these conditions were 2–3 tons per acre.

Bulk of the sorghum grain areas was sown in row spacing of 14 in, but there was a movement to wider row spacing with availability of row-crop machinery and irrigation development.

Demand for sorghum grain was accentuated by drought conditions. Stock-feed manufacturers were concerned at the low grain-protein, following the changeover to hybrids. The manufacturers in most cases purchased their needs only after a protein test.

Tests of grain harvested from district trials showed a protein range from 5.9 per cent to 16.7 per cent. There appeared to be some protein-variation due to the higher yielding-ability of hybrids, but soil-fertility was the main factor. Under good soil-conditions hybrids appeared capable of grain with a protein test of 15 per cent.

Fertilizer and Irrigation Trends.—Superphosphate was applied generally to the grain sorghum crop.

Where irrigation was available there was interest in nitrogen. Trials at Finley, with irrigation, showed significant yield responses to nitrogen. Yields were increased from 65 bushels to 83 bushels by application of 90 lb nitrogen. There was no difference from split applications of nitrogen, at sowing and four weeks after sowing, nor by applying the total nitrogen four weeks or six weeks after sowing.

Timely watering was shown to be essential for best yields. Efficient irrigating gave a mean yield of 85 bushels, compared with 70 bushels where irrigations were reduced from nine to seven.

Near 100 *Per Cent Use of Hybrid Seed.*—The changeover to the use of hybrid seed was practically 100 per cent. Seed of both New South Wales and Queensland produced hybrids was freely available.

The association of local seed firms with those of America caused keen competition in hybrid-seed production. Hybrid numbers increased at a striking rate. Tx610 and Brolga remained the leading hybrids. But seed of Texas hybrids, Tx608, Tx621, Tx671, Tx625, Tx626, the DeKalb hybrids F63A, F64, E57, C45A, E56A, C45B, the Northrup King hybrids ANK310, ANK212, and the Pioneer hybrid 846 were produced in increasing quantities. Early-maturing hybrids suited all New South Wales districts.

Grain size, grain colour, and standability were given more prominence in development of new hybrids.

District Testing of Hybrids.—Rapidity of hybrid development made testing difficult. Eight District tests were undertaken, with all commercial hybrids. There was no outstanding yield difference between hybrids, but there was an average yield-improvement of 24 per cent by the leading hybrid over the open-pollinated varieties 7078 and Alpha.

Hybrid-breeding Programme Ended.—The breeding programme at Tamworth Agricultural Research Station was terminated. All of the breeding material was offered to the Department of Primary Industries, Queensland, for its programmes.

Facilities at the Narrabri and Tamworth Agricultural Research Stations were made available to the Queensland Department for testing experimental hybrids prior to release and certification.

Certified Seed Production.—This was confined to 50 acres of Tx610, and one grower, although leading male-sterile and restorer lines for hybrid development were maintained and increased at the Narrabri Agricultural Research Station.

Growers had no difficulty in getting certified seed of Texas hybrids from Queensland.

Production of DeKalb and Northrup King hybrids was mostly centred in N.S.W.

The DeKalb Seed Company, and Arthur Yates, developing Northrup King hybrids, concentrated their efforts in the Griffith, Finley, and Berrigan districts and got very satisfactory seed yields with irrigation. Drying apparatus was installed at Berrigan and at Griffith to dry seed immediately after harvest, before consignment for grading and packeting.

FORAGE SORGHUMS

Status Increased by Drought.—The fodder-value of sorghum was highlighted by the drought. With serious shortage of bulk-fodder, the summer sowing was the heaviest yet. Hybrids Sudax SX11, Zulu, Calala, sudan grasses and sweet sorghums were freely used in practically every district, and on many farms for the first time.

The sorghum crop helped to save many stock. Moreover, the rapid recovery, of the hybrids in particular, after summer storms, enabled conservation of considerable silage and hay.

Extension advice on the sowing and utilization of sorghums was intense, throughout the year.

Hybrids' Seed Supplies.—Because of their wide use and excellent performance, hybrids are now firmly established.

Seed supplies of hybrids Zula and Calala were limited but production of about 500 tons of seed of the DeKalb hybrid Sudax SX11 in Finley-Berrigan district alone ensured its wider distribution and use. Demand for Sudax resulted in 600 acres being sown for seed purposes in the Finley district. This doubles the area of the previous season, and about 1,000 tons of seed was expected.

Seed supplies of the Northrup King hybrid Trudan were built up in the Griffith district. Also, Sordan, a new forage hybrid, was put into production.

One grower produced seed of the Departmental hybrid Calala and built up foundation-seed supplies.

Due to the wide publicity given Sudax, landowners commenced to regard all hybrids as Sudax—remindful of the way sweet sorghum initially became known to many as Saccaline.

Yield Comparisons and Utilization Research.—Research continued into the utilization of sorghum, and also yield-comparison trials of hybrids Sudax SX11, Sudax SX12, Calala, Zulu, Trudan, and F22, the sudan grass varieties Piper, SS6, Lahoma, and the sweet sorghum varieties Tracy, Early Orange, and Sugardrip.

Growth-curve studies at Narrabri showed that with irrigation and fertile soil 30,000 lb of dry matter per acre could be expected from hybrids.

Yield comparisons from this trial throughout the State were confusing but indicated that time of sowing, grazing-management and soil temperatures had a large bearing on performances.

The sudan-grass hybrids showed to advantage throughout the season because of their great recovery following grazing. They appeared more suitable than sweet-sorghum hybrids.

There was little yield difference between hybrids Sudax, Zulu, and Calala; and although Trudan performed satisfactorily it was disappointing in some areas. Trudan was more affected by leaf blight (*Helminthosporium turcicum*) than were other hybrids in one coastal trial.

The sudan-grass variety Piper again showed distinct promise. In early grazing it was not inferior to hybrids. Piper was superior to other commercially used sudans, SS6 and Lahoma, and seed was produced for its commercial use.

For silage or standover autumn-feed, sweet sorghum varieties appeared to be the equal of hybrids. The varieties Tracy and Early Orange did best. When sown sufficiently early, hybrids showed to advantage by providing two silage cuts, or one silage-cut and standover autumn-fodder.

State of Improvement Programme.—Male-sterile lines were retained and seed-increased at the Narrabri Agricultural Research Station. But all breeding-material and experimental hybrids were forwarded to the Department of Primary Industries, Queensland, for plant breeder use there.

Seed Certification Scheme.—Seventy-seven acres of sweet sorghum were registered for certification. They comprised 30 acres of Saccaline, 43 acres of Early Orange and 4 acres of Tracy. All production was confined to the Moruya district. The harvest was estimated at 2,000 bushels. Registration of sudan grass for seed certification comprised 170 acres of SS6. Dry seasonal conditions were expected to cause a light seed-harvest.

BROOM MILLET

Production and Market Trends.—Production of broom-millet fibre was estimated at 600 tons, from 1,830 acres; about 60 tons more than in the previous season.

Tumut–Gundagai, Richmond, and Hunter River districts were the main producing-centres. About 40 tons was produced under irrigation at Barham.

Seasonal conditions in the Richmond and Hunter River districts were difficult and a reduced acreage was sown there. The Tumut area, about 1,200 acres, was bigger than in the previous season.

Prices for millet fibre were generally satisfactory; over $200 per ton for best quality. Competition between buyers was keen. One manufacturer, unable to obtain his normal supplies of quality fibre, took action to import from Argentina.

Labour for broom-millet harvesting caused concern. This is leading experienced growers in the Richmond and Hunter River districts towards alternative crops.

Larger acreages were sown to the improved White Italian strain. This strain satisfies growers and buyers.

Introductions for Improvement Programme.—Dwarf-millet lines were introduced from Canada for testing.

FODDER AND GRAIN MILLETS

Production.—Production of fodder and grain millets was light. Victoria and Queensland supplied most of the New South Wales requirements, at higher than normal prices.

Pearl Millet Trials and Improvement Programme.—The value of pearl millets was proved in trials throughout the State. Pearl millets Katherine and PC10 from Senegal showed their high yielding ability and superiority over Japanese, particularly for prolonged grazing. Increased quantities of Katherine seed were produced.

A promising pearl millet selection developed at Tamworth Agricultural Research Station was seed-increased. This selection was earlier than Katherine, was non-hairy and had distinctly better seed-production possibilities.

RICE

Production-Records.—For the fifth consecutive time the year's production was record-breaking. The estimated harvest is 180,000 tons of paddy from 64,200 acres, compared with the previous record (1964–65) of 150,000 tons from 61,600 acres.

Still more significant is the new world-record yield average of 2.78 tons per acre; well ahead of the previous record—2.64 tons per acre established in 1958–59.

The record 1965–66 crop will return to growers a total sum approaching $11,000,000.

Climatic conditions were highly favourable, particularly over the flowering period, but credit for the record performances must be given in the main to the growers. Their production and management methods are constantly advancing. And this reflects their close association with and ready responses to the Department's research and extension programmes.

With continued financial support from industry, the already intensive rice research programme at Yanco Agricultural College and Research Station and in rice districts has been expanded to more than 80 projects and trials. *Inter alia,* the highest experimental-yield ever achieved was recorded last season, at 6.25 tons per acre.

At least 70 per cent of the processed 1965–66 crop will be exported, and, despite the significant increase in production, markets to absorb the entire output have been established. In fact, the market needs will again exceed the supply. This has led the rice industry organizations to seek an increase of 10 per cent in individual acreage-allocations.

Variety Trend.—The industry was developed on the variety Caloro II, but continues to show increasing preference for the relatively new variety, Calrose. For the second successive season, the yield average from Calrose exceeded that of Caloro II. This reflects the remarkable improvement on Caloro II through the Department's selection-programme.

Aerial Seeding and Topdressing.—Aerial seeding and aerial topdressing have increased. In the Murray Valley districts about 800 acres was aerially-sown and the new season's total seems likely to exceed 5,000 acres.

The problem of poor seed-dispersal from the air had been solved by research at the Yanco Agricultural Research Station. The technique was in fact demonstrated as an effective means of beating weeds and of improving rice-establishment on poorly-structured soils.

Topdressing from the air was applied to some 10,000 acres of rice in the Murrumbidgee districts this year. And its success was in part the outcome of local research

Nitrogenous Fertilizer Trend.—Anhydrous ammonia was used on a commercial scale for the first time. Research had shown that this source of nitrogen was at least the equal of sulphate of ammonia—used almost exclusively for many years.

Bulk-handling and Bulk-storage.—The industry has developed these facilities to the stage that almost the entire crop can now be received in bulk.

Breeding and Improvement.—Quarantining of all introduced rice-varieties at Hawkesbury Agricultural College was continued, to preserve the unique disease-free status of the rice industry. This year, eight introductions were obtained—from India, Italy, and the U.S.A. This additional material is to be assessed for glutinous-rice production, and for breeding towards salt-tolerance and low-temperature tolerance.

Highlight of the breeding programme is the outstanding performance of the varieties recently released under the code names of YRL 1 and YRL 2. Special attention has been drawn to them in an earlier section of this Annual Report of the Department (see page 16). These new varieties comprise the first releases from a completely local breeding-programme. They have gained world-wide recognition in combining long- and fine-shaped grain with oustanding yields.

Further promising material has emerged from the breeding programme. Quality-appraisal now receives increased attention, through installation of specialized laboratory equipment.

Cold-tolerance and Salt-tolerance Aims.—The newer breeding-programmes are designed to incorporate cold-tolerance at flowering, and also salt-tolerance. These programmes advanced satisfactorily. Several varieties from Japan have shown excellent tolerance when tested in the Murray Valley environment.

Deep-frozen Seed Storage.—Promising early results have been achieved in a research programme designed to investigate the feasibility of extended storage of nucleus seed of fixed commercial varieties by deep freezing.

Nutrition and Establishment Research.—Sixty-one nitrogen trials were sown in the Murrumbidgee districts, aimed at clarifying the correlation between soil-nitrogen analyses and predicted crop-nitrogen requirements. Data were assembled for computer analysis. The final results are not yet available.

Standard fertilizer-trials were again conducted in the Murray Valley districts, to obtain more detailed data on crop-nutrition needs over a range of soils and fertility levels.

Seed Treatment Research.—This continued to produce improved plant-establishment. But this season's conditions so favoured germination that no significant yield-improvement occurred.

In a pilot-trial with gypsum broadcast on a poorly structured soil, there was marked improvement in crop-establishment but no yield-increase.

Topdressing Research.—This provided more detailed information about time of application but indicated no advantage in applying part of the nitrogen total at sowing and the balance as topdressing, by comparison with a single application of the total at sowing.

Aerial-sowing Research.—Previous research into aerial-sowing of seed on to grazed-off pasture was extended into the district on a commercial scale. The results were highly satisfactory.

Soil Testing.—Soil samples from more than 330 rice properties were collected by agronomy staff and analysed by the rice chemist. Based on the analyses and previous research, predictions were made and recommendations were given to the growers for nitrogenous-fertilizer rates. The predictions proved to be generally accurate for the Murrumbidgee districts; but discrepancies occurred again in the Murray districts.

Forage Legumes

VETCHES

The vetch crop was again used extensively throughout the far north coast to supplement early-spring grazing. Golden Tares remained the prominent variety. Seed supplies were still confined to Tasmanian sources.

Research and extension with the vetch crop continued. Introductions were made and observed for disease-resistance and vegetative growth.

The dry season resulted in a little loss from the two main diseases, root rot and stem decline. A plant pathologist from Wollongbar Agricultural Research Station continued to study these diseases.

COWPEAS

Cowpea seed was in short supply and the high seed-price discouraged extensive use for grazing. The crop proved hardy and gave valuable grazing.

The variety Poona was still prominent but Malabar and Caloona, because of their better disease-resistance, were sown over a wider area. New varieties Meringa and Mulgrave, developed for disease resistance, were seed-increased.

Interest in production of cowpea grain increased but the harvest was light, due to drought. Production of grain was confined to the northwest. Top yield was five bags per acre.

Seed certification was confined to the Coonabarabran district. There, five growers registered 220 acres of the variety Caloona for certification.

DOLICHOS LAB LAB

Superiority of *Dolichos lab lab* over cowpeas for late-autumn grazing and in disease-resistance was proved in coastal and northern irrigation districts. Seed was built up to a satisfactory level by city seed firms.

Cotton

Acreage and Production Trends.—Rapid growth of the cotton industry continued to be a highlight of agricultural trends in New South Wales. High yields have provided impetus for further expansion.

From 1959–60 planting of 97 acres, rising to 2,359 acres in 1962–63 and 11,000 acres in 1963–64, N.S.W. cotton acreage in 1965–66 reached a new record of 31,600 sown acres producing 70,000 bales. The approximate 30,000 acres sown in the Namoi area produced 68,000 bales, valued at about $12,000,000. The variety was Deltapine Smoothleaf, to the virtual exclusion of others.

Growers in the Namoi area have indicated that production would be expanded if irrigation water were available. But the water-storage position at Keepit Dam has obscured the expansion plans. Growers are adopting various plans in anticipation of severe water-shortage in 1966–67. There will be at least a small acreage of cotton using underground water sources. This is unlikely to exceed 3,000 acres.

Immediate expansion of the industry in southern areas is limited by lack of suitable varieties for the environment. Namoi expansion is limited by availability of water. Also, water-shortage through the drought's effect on storage has restricted developments planned in the Macquarie River area.

Yields.—The yield average of raw cotton in the Namoi areas was 2.25 bales per acre. Individual areas yielded three bales and more. A yield average in excess of three bales per acre was claimed for one crop of 960 acres. Southern crops average ¾ bale per acre, whilst the best crops there produced 1.75 bales per acre.

Ginning Capacity.—In the Namoi area this was greatly expanded. Prior to the last season two ginneries operated, each of four 79-saw stands. Three further ginneries were erected in 1965–66; one a four-stand unit, the others three-stand units. Each stand comprised 119 saws. This expansion has increased ginning capacity to almost three times that of the preceding season. The approximate cost of the expansion was $1,000,000.

Fibre Quality Good.—Fibre quality was again good, although some prematurely-picked and low-micronaire cotton were received.

Plans for erection of a special laboratory at Rydalmere for the Department, to test cotton fibre-characteristics, have been delayed by changes in the building programme. Meantime, arrangements for use of facilities at the University of New South Wales and elsewhere have continued. The laboratory-staff establishment was increased this year by appointment of an assistant-in-training.

Commonwealth Bounty.—The Raw Cotton Bounty Act of 1963–65 applied to the 1965–66 crop. The bounty is based upon grade and staple-length of raw cotton. A scale of discounts and premiums below and above the bounty payment of 13.4375 cents per pound for "middling one inch white" is used to determine bounty payments. The bounty-average for the 1965–66 crop was expected to be 8.5 cents per pound, a third less than in the previous season.

Breeding and Improvement.—The improvement programme continued to expand. A collection comprising 36 varieties and strains was examined in Stage I replicated tests. Some 30,000 selfings were made at Narrabri Agricultural Research Station.

Provision of a heated glasshouse at Narrabri speeded-up the cross-breeding programme. The F_1 plants have been grown in the glasshouse in the 1966 winter.

A *Verticillium* nursery was established, in the programme to develop varieties tolerant or resistant to this disease.

Progeny testing of the most promising varieties and hybrids continued.

Selections were made within the 21 new introductions grown under quarantine.

Variety Testing.—Variety testing continued at Narrabri Agricultural Research Station and at two distinctly different commercial sites in the Namoi area. Similarly, in the south, testing was done at Yanco Agricultural College and Research Station and at seven district sites with CSIRO co-operation.

Deltapine Smoothleaf was the leading variety in the Namoi trials, though only slightly superior to Stoneville 7–02. In one trial Stoneville 7A, Carolina Queen and Deltapine 45 also did well. Stage II testing comprised 16 varieties in the on-station trial and six in the two off-station trials. Stage III testing comprised 10 varieties in the on-station trial and five in two off-station trials.

Yields in the Namoi trials ranged from 1,250 to 1,900 lb of lint per acre; equivalent to a range from 2.5 to 3.4 bales per acre.

In the south, 12 varieties were tested in Stage I trials, 18 in Stage II trials and nine in Stage III trials, at eight sites. Final harvest data were not available at 30th June, 1966.

Pure-seed Supplies.—Cross-pollination occurs readily between cotton strains and varieties. Thus, special measures have to be taken for continued supply of pure seed of all new and promising material and also "nucleus" seed of commercial varieties. The special measures include "selfing", by bagging flowers to eliminate insect activity, and production of plants in an insect-proof enclosure.

By those methods small quantities of seed are produced for initial testing and seed-increase. The seed-increase is achieved by growing small plots in areas isolated from other cotton. This programme required more time and labour in the past year, to provide increased seed supplies for future testing.

In the 1964–65 season the Namoi Cotton Seed Association produced seed on an acre of Stoneville 7–02, and Austin BR–07, derived from the pure-seed programme. In 1965–66 the Stoneville 7–02 project was expanded to 46 acres and produced about 40 tons of fuzzy seed. The Austin BR–07 was held in reserve.

Similarly, in the 1964–65 season Dixie King 27 was grown in southern areas and was further seed-increased in 1965–66.

A significant commercial development for pure-seed production was the establishment of an acid delinting-plant at Wee Waa by the Namoi Cotton Seed Association. Acid-delinted seed has advantages over mechanically-delinted seed. Disease contamination is reduced, more precise sowing is possible, and the seed has superior quality.

To maintain the high standard of cotton in the Namoi area, a recently introduced strain of Deltapine Smoothleaf was released to the Namoi Cotton Seed Association and was grown on a skip-row system for maximum seed-production.

Production Research.—Research was concentrated in the Namoi and the M.I.A./Coleambally areas. There was lesser activity in the Murray and Macquarie areas.

In the Namoi Area: As in preceding years an irrigation "cut-off" trial was conducted. The final irrigations were applied at weekly intervals from 15th February to 15th March. Results, as in 1964–65, indicated that "cut-off" very early in March was superior.

Cotton-nutrient investigations involved much of the resources. The important nutrient-problem in the Namoi area is nitrogen supply. Work on this was expanded to nine trials, each involving some 24 plots. These trials were "petiole"-sampled regularly for analyses by the Chemistry Branch, Division of Science Services. Preliminary results suggest that 80–120 lb of nitrogen per acre is needed in most situations.

Two pilot trials were conducted to test the possibility of other nutrient-deficiencies in the Namoi area, particularly potash, phosphorus, magnesium, manganese, zinc, boron, iron, and copper. No deficiencies were observed.

Defoliation trials also were conducted, to assess the merits of chlorate and organic phosphate materials as harvest-aid chemicals. These were examined alone and in combination with other materials such as amino-triazol.

Insecticide-trials examined the use of chemicals for control of Rough Bollworm, compared to the standard Endrin-treatment.

In the M.I.A. and Coleambally Areas: An irrigation "cut-off" trial was conducted at Yanco Agricultural College and Research Station. "Cut-off" dates ranged over two months. As in 1964–65, ample irrigation throughout the season resulted in highest yields. Premature "cut-off" in late January and mid-February reduced yields.

A cultivation-trial to assess the effect of deep ploughing or ripping indicated advantages for deep ploughing as compared to normal ploughing.

Chlorate- and phosphate-defoliants were tested, and better-conditioned plants resulted where chlorates were used.

Weed-investigations included new and promising herbicides, methods, and comparison of herbicides with cultivation and flame methods.

Rough Bollworm control-plots of carbaryl, azinphos and toxaphane–DDT were compared with untreated areas.

Murray Irrigation districts and Macquarie River districts with a potential for cotton growing were tested by trial-projects.

Strict Quarantine.—Strict precautions have been maintained in growing cotton-introductions. No quarantine material is in areas producing cotton or considered suitable for cotton production.

As in the preceding season, a specially bee-proofed glass-house at Glen Innes Agricultural Research Station was used for quarantine production of small introductions. These plants were inspected throughout the growing period. Single-plant selections were made by the cotton plant breeder, subject to the selections meeting quarantine requirements.

Almost 50 per cent of the quarantine material in 1965–66 was introduced by the Namoi Cotton Seed Association. The Department has access to the new material. This comprises Deltapine Smoothleaf, Deltapine 45A, Deltapine 4450 and two lines of Hopicala—a recent release from New Mexico.

Tobacco

Acreage, Yield and Quality Trends.—The tobacco industry in northern N.S.W. has declined in acreage over the past two seasons. From a peak 2,835 acres in 1963–64 the planted area fell to 2,368 acres in 1964–65 and to 1,618 acres in 1965–66.

The greatest falls have been in the Texas/Yetman and Texas/Tenterfield areas but there have also been marked changes in the Severn Rivers/Graman and Wallangara areas. The Bonshaw/Ashford district has been least affected.

This year the shortage of irrigation water delayed planting in some areas. Also, hot-dry midsummer conditions were against production of good quality tobacco. Even so, leaf-quality was better than from the preceding season and yield average was above normal—it approached 1,100 lb per acre.

Marketing.—The newly adopted marketing-system under the stabilization scheme operated smoothly. Price-averages were good, and only a very small percentage of leaf was unsold.

Nutrition and Other Research.—Investigations were conducted into nitrogen, phosphorus and potash fertilizer needs of tobacco.

Trials were also conducted in regard to sucker control, herbicides, nematode-resistance and mosaic-resistance.

Variety Improvement Programme.—Pure-lining of the variety Hicks was continued. Also, seven new varieties were introduced from New Zealand and the U.S.A.

Linseed

Production.—Over-production from the 1964–65 crop had been considerable, relative to markets. This, and the drought, led to 1965–66 production of only 200 tons of linseed from a 2,300 acre sowing—compared to the 8,760 tons from 23,769 acres in 1964–65.

Variety Improvement Programme.—Lacking a linseed breeder, the improvement work was confined to testing the recent introduction and the best varieties from the World Collection.

Testing was arranged at five Research Stations and, through District agronomists, on farm properties. The drought conditions either prevented sowings, or caused failures of most of the dryland trials.

At Condobolin the varieties Bonnydoon, Lin de Tunis and Kameniza were showing greatest promise before the crop failed. The same varieties were prominent at Temora. There, Kameniza withstood dry conditions better than the others did.

In Stage II testing, varieties were compared in two maturity-groups at Narrabri. This was under irrigation. In the early-maturing group, Marine Redwood, Bonnydoon and Wells were highest yielding—in that order. In the late-maturing group, Bonnydoon, Zona Rosafe, Hollandischer and Calar were the highest producers.

Similarly at Leeton, under irrigation, in spite of losses due to weed growth, Bonnydoon, Lin de Tunis and Kameniza were the leading varieties in the late-maturing group. Calar, Bonnydoon and Uraguay had the best production record in the late-sown trial.

Of particular interest, Bonnydoon was a leading variety in all four irrigated trials.

Nutrition Research.—At Condobolin Agricultural Research Station a trial to investigate the nitrogen and phosphate needs of linseed in that environment was started. Phosphate-response was noted within one month of sowing. The higher rates speeded growth by up to two weeks until the trial failed in the drought.

At Narrabri Agricultural Research Station there was no apparent response in a trial aimed at correction of zinc deficiency by solid fertilizer treatment. Zinc deficiency is often experienced at this Station.

Pure Seed Production.—Pure seed was produced under irrigation at Narrabri and Leeton.

Arrangements have been made to continue in 1966–67 the pure-seed increase of promising varieties, and seed-increase also of 18 introductions in quarantine.

Soybeans

Production and Consumption.—The Australian soybean crop has never been an important one, but recently-expressed grower and industry interest, and the market-potential, have pointed to the need for more research.

Annual use of soybean oil exceeds 1,000,000 gallons. Also, soybean-meal importation has recently increased—to a reported total of 10,000 tons in the six months to 30th June, 1966.

Variety Investigations.—Successful soybean production hinges on selection of varieties suiting a particular zone or latitude.

Detailed trials to examine the adaptability of varieties to specific areas were planned for 1965–66. Because of the drought, the trials were subsequently confined to Leeton and Narrabri Agricultural Research Stations. Results so far have added to the Department's knowledge of selected varieties' adaptability. This investigation of the basic problem will continue in the 1966–67 season.

Introductions and Pure Seed.—Ten soybean varieties from U.S.A. were seed-increased twice during the year; at first in a quarantine glasshouse and later in the field.

Pure seed production was done at Glen Innes, Narrabri, Orange, and Yanco Research Stations.

In all fifty-five varieties were seed-increased.

Safflower

Production Trends.—Interest in safflower continued to increase throughout Australia. Queensland remained the major producer. In the five years to 1964–65 production increased eightfold there, and showed another big increase in 1965–66. Average yield per acre over the five years was 14.1 bushels, compared with a ten-year average of 9.9 bushels per acre in N.S.W.

The 1964–65 season had been a favourable one and the yield average in N.S.W. was 14.8 bushels per acre, from a record area of 2,253 acres. But in 1965–66 the northern crops, mainly in the Bellata and Croppa Creek districts, failed and those in the central west and south, small in number and in area, yielded very lowly.

Major fluctuations in yield averages, even under irrigation, have occurred over the years. Therefore, growers have been advised that safflower should be regarded only as an "experimental" crop.

Research Programme.—Variety trials were arranged in six districts, but due to drought either were not sown or failed.

At Leeton Agricultural Research Station, *Phytophthora* destroyed all trials.

Trials, also, to investigate seeding rates, fertilizer needs, and irrigation "cut-off" have been established at the Leeton Station.

Pure-Seed Programme.—Seven unnamed lines were seed-increased, but the quantities were not great—because of the drought.

Castor Bean

Variety Investigations.—These were restricted to Leeton Agricultural Research Station. A replicated variety-trial was conducted there.

Under the conditions of this season most of the varieties showed satisfactory non-shattering characteristics.

The highest yields approached a ton per acre. Hale and Interspersed Dawn, in that order, produced the highest yields. Hale's performance confirmed its earlier results.

Pure Seed Production.—Seed-increase areas were on nine Research Stations, for thirteen varieties. Isolation of seed-increase areas is essential for pure-seed production.

Six more varieties were introduced from U.S.A. and are in quarantine.

Minor Miscellaneous Crops

SESAME

Introduced varieties were seed-increased at five Research Stations, to produce enough seed for future variety-testing.

RAPE SEED

Seed-increase of introductions continued, in preparation for variety-testing. Some recently developed Canadian varieties were received for seed-increase and testing.

LAVENDER

A nursery area was maintained.

PYRETHRUM

A nursery area was maintained.

CANARY SEED

The last-recorded acreage of this crop in N.S.W. was 1,139 acres in 1963–64. Some seed-increase was done in 1965–66.

PEANUTS

Acreage of peanuts fell to 300; 25 per cent less than in the preceding season. This reflected market and seasonal conditions.

Vegetables

GENERAL

The vegetable-research programme met some difficulties: the research officer for vegetable investigations at Yanco Agricultural College and Research Station was selected to attend a genetics course at CSIRO, Canberra, and research at Yanco had to be confined to maintenance of breeding lines plus limited selection; the newly-appointed potato breeder at Glen Innes Agricultural Research Station had a most difficult drought season in his first year; the position of research agronomist at Orange Agricultural Research Station was not filled till March, 1966; at Hawkesbury Agricultural College the research officer on vegetable work was ill for a long period.

However, useful selections of advanced generations were made—of beans and tomatoes at Hawkesbury Agricultural College, and of potatoes at Glen Innes.

Several matters affecting marketing and presentation of vegetables received attention: new grade-regulations for tomatoes were found to be satisfactory; an approach for uniform grading-regulations was made by the Department of Primary Industries, Queensland, and is under consideration, in view of the extensive trade between the two States; new branding requirements for potatoes were applied with advantage to the trade; the contentious question of the manner of selling beans and peas, per unit-package or per lb, was discussed between representatives of growers, agents, and the Department, and an agreement was reached for sales to be made per lb.

POTATOES

Breeding for Variety Improvements.—Potato breeding continued at the Agricultural Research Station, Glen Innes. All aspects functioned normally except for the field plots of second- to fourth-year seedlings. Drought severely limited the selection procedures for these.

Some 233 successful crosses were made, for a harvest of 1,034 seed balls; 48 female and 39 male parents were used. The most-used female parents were F4724 from Canada, Kennebec, Penobscot Superior, and B5063–3 from U.S.A., and Monak and a wide range of seedlings developed by this Department. The range of male parents used comprised mainly local lines developed from overseas materials, e.g., B595–76, and some U.S.A. varieties—Menominee, Saranac, Yampa, and Katahdin.

A total of 15,000 *first-year seedlings* were glasshouse-grown, representing 343 lines. There are attractive progenies from crosses involving Blanca, Aquila, Osage, Fundy, and Haig, in combination with locally-developed seedlings.

At the potato substation, 3,175 *second-year seedlings* were grown, representing selections from 177 different lines, and 500 were selected for advancement into third year. Tuber-quality was particularly high. The outstanding selections were two lines from the cross F4724 x (Segabo x 11–79). Other promising selections were from Kennebec x (Delus x S2782), Redskin x Exton, S2861 x Exton, Kennebec x S2856, and Navajo x S2782.

In the *third-year seedling block* 198 *lines* were grown, and 67 were selected from these. Five lines from the cross Fundy x (B595–76 x Adina), two lines from Blanca x Katahdin, and one from Bungama x (Delus x S3782) were outstanding.

This year 180 *fourth-year seedlings* were planted, at Red Range, and 70 selections were made. Promising selections were made from (S2776 x Katahdin) x S2782, Olev x S2782, Navajo x (11–79 x Cherokee), 95–78 x (Sebago x 11–79), and B595–76 x Katahdin.

In the *preliminary yield trial,* this year grown at Orange Agricultural Research Station, 15 early-maturing and 12 late-maturing seedlings compared with standard varieties. Seedlings derived from Kurrel x Osage, Ontario x S2856 and two lines from (Sebago x 11–79) x Redskin did best.

Breeding for Resistance to Common Scab (Streptomyces scabies).—Further tests were done at Glen Innes by transplanting 4,000 seedlings into infected soil in the glasshouse. Resistance was derived from several parents, including Menominee, Cherokee, Avon, B5063–3 and F4724.

Ten seedlings and varieties grown at Orange Agricultural Research Station were rated for resistance. Seedlings S2897 (Redskin nat. pollination), S2904 (B595–76 x S2782), S2887 (Crana x Redskin), and S2902 (Delus x Redskin) all showed a high level of resistance, compared with the susceptible check-variety Sebago.

Breeding for Resistance to Potato Virus Y.—Further tests of the reaction of five advanced seedlings were conducted by Biology Branch, Division of Science Services. Tubers from a plant of S2897 which last year seemed to have some resistance, this year gave rise to rugose mosaic infected plants. It was apparently a case of late-season infection.

The seedling S2893 (66–10 x 11–79) showed a low percentage of tuber-transmission of P.V.Y., while reactions of the seedling S2904 (B595–76 x S2782) indicated an absence of tuber-transmission.

The very low percentage of infection in Norgleam justified a claim for its high degree of field resistance to P.V.Y. Seedlings S2890 (Sequoia x Cotland) and S2902 (Delus x Redskin) reacted satisfactorily with the development of a leaf-drop streak reaction.

In general, seedlings S2893, S2904, S2889 (B595–76 x Adina), and S2901 (S2864 x Merrimack) again showed a high field-resistance to current season P.V.Y. infection. A seedling plant each of S2889 and 2901 which did become infected, again exhibited the leaf-drop streak reaction.

Advanced Yield Trials.—Two drought years in succession, after the outbreak of disease in the seed-increase plots on the central tablelands, has allowed only the most important advanced yield trials to be conducted.

On the northern tablelands, 16 early-maturing seedlings and eight late-maturing seedlings were compared with standard commercial varieties. The most promising line in the early-maturing trial was S2939, a selection from the cross

Monak x Cherokee. This gave a good yield of excellent quality attractively-shaped white-skinned tubers. In the late-maturing section, seedlings S2940 and S2941 both produced good yields of attractive tubers of high specific gravity.

At Orange Research Station 12 early-maturing and nine late-maturing seedlings and varieties were compared with standard commercial varieties. In the early-maturing section, seedlings S2893 (66–10 x 11–79) and S2890 (Sequoia x Cortland) performed well. In the late-maturing section, S2881 (Awaba x 336–123) and S2885 (Awaba x 336–123) were best, with Kurrel. Kurrel again gave the highest yield.

In the main seed-increase area at Orange, seedlings S2897, S2881, and S2885 were best. The new red-skinned U.S.A. variety Excel also did well.

Advanced-seedlings and varieties were supplied to research workers in other States. In Western Australia, the red-skinned S2897 showed good yield and quality and a high degree of resistance to common scab. A selection from the cross (B3095–18 x S2856) also showed promise. In South Australia the seedling S2881 continued to show great promise, and Kurrel and Murru again did well. Kurrel also gave a good performance in Queensland. Its popularity is rapidly increasing there.

Elite-Seed Production.—The programme of elite-seed selection and production continued at Orange Research Station. Because of the dry season, and being unirrigated, yields were lower than anticipated with early-maturing varieties. A further year's production is needed before this seed can be introduced into the certified-seed scheme.

Disease-free stocks of Kurrel, Bungama, Sequoia, Exton, Sebago, and Kennebec have been maintained. And original single-plant selections of Katahdin, Saranac, and other less important varieties have been built up.

A programme of tuber-indexing followed by tuber unit-planting was initiated on a small scale. A very low percentage of suspected virus infection was observed. Microscopic and indexing texts showed the amount of virus disease to be negligible.

Further single-plant selections have been made from each variety and each of the most promising advanced-seedlings.

Potato Quality Tests.—Ten advanced seedlings were subjected to cooking tests. All seem likely at least to equal the major commercial varieties.

Specific gravity was determined for all seedlings and varieties and for the products of various fertilizer treatments at the Orange Research Station, and on all advanced seedlings at Glen Innes Research Station.

The specific gravity readings on the Glen Innes seedlings were uniformly high. A selection from Olev x Katahdin had a specific gravity of 1.102. Olev was originally from Estonia. Another, Olev x S2782, gave a 1.096 reading. Readings in excess of 1.090 were common. The comparisons were with Sebago 1.080, and Kurrel 1.084.

At Orange Research Station the seedling S2893 (66–10 x 11–79) once again had highest specific gravity. This seedling was also tested for chipping quality and was very satisfactory for colour, even without reconditioning.

At Orange Research Station, specific gravity determinations were made on triplicate samples from each treatment in a comprehensive fertilizer trial. The same procedure was adopted for a trial designed to compare the effect of varying rates of the chloride and sulphate salts of potash on yield and tuber quality. Preliminary assessment of the results indicates that increasing rates of nitrogen cause a progressive decline in specific gravity, and that higher rates of potassium chloride cause lower specific gravity than do equivalent rates of potassium sulphate.

Seed Production.—In the Potato Seed Certification Scheme 690 acres, submitted by 79 growers, were certified; as against the previous season's 800 acres, submitted by 72 growers. Rate of rejection was 2½ per cent compared with 3 per cent in the previous season.

A Seed Approval Scheme was introduced this year to supplement the amount of good quality seed available to commercial growers. In this first year of operation 213 acres, submitted by 19 growers, were passed as suitable. Rate of rejection was low.

Introductions.—Twelve recent introductions from the U.S.A. were grown at Orange. A new one, Pennchip, was grown in quarantine. Reliance, Penobscot, and Snowflake performed well.

TOMATOES

Breeding.—At Hawkesbury Agricultural College all breeding lines were tested for *Fusarium*-wilt resistance in the glasshouse by artificial inoculation. Following this screening, 33 crossbred selections in advanced generations, two fixed lines, and eight varieties were grown for observation; and 10 crossbred lines and four varieties were included in a replicated yield-trial.

Two lines of the cross Anahu x Step 286 in the F8 generation have shown special promise. They have multiple disease-resistance, attractive fruit quality and high yield.

Other selections showing great promise were from the cross (Kokomo x Rouge de Marmande) x Rouge de Marmande. These lines are resistant to *Fusarium*-wilt and retain the Rouge de Marmande ability to set fruit in extremely cold weather. They are in the 5th generation since back-crossing.

All hybrid tomatoes were grown in a separate trial. Fifteen new combinations of smooth-fruited varieties, and eight new combinations between smooth-fruited varieties and Chinese Red varieties, were tested. Of the smooth-fruited hybrids, Oahu x V458 and HES6586 x V548 produced wilt-resistant and leaf mould-resistant plants that were early in maturity and of high yield. The crosses Oahu x Grosse Lisse and HES6586 x Grosse Lisse produced wilt-resistant plants with high yields of good quality fruit. HES6586 x Rouge de Marmande and Oahu x Rouge de Marmande were best of the hybrids that have a Chinese Red variety as one parent. Both of these hybrids produced smoother fruit than Rouge de Marmande and were high yielding.

At Yanco Research Station the reproduction of breeding material was continued, and limited selection was done within promising lines.

It is noteworthy that about 60 per cent of the acreage in the M.I.A. devoted to growing tomatoes for processing was occupied this year by varieties originally tested or developed at the Yanco Station.

Variety Trials.—In a field trial at Dubbo, the variety College Challenger and the College Cropwell hybrid proved superior to Grosse Lisse and Indian River.

Trial of varieties in relation to mechanical harvesting has become significant. For example, a grower in the M.I.A. cropped 230 acres of tomatoes under contract to a processing firm. Mechanical harvesting must be considered for such large-scale production.

Seed of varieties showing potential for mechanical harvesting were under trial and seed-increase. VF145–22–8, from the University of California, showed most potential.

Introductions.—Eastern States 24, STEP372 and STEP392, all from the U.S.A., showed promise as staked crops at Hawkesbury Agricultural College. Korai Buda and Gonfu Norma, from Hungary, showed potential as parents. Of 18 introductions grown at Yanco two selections from Long John, from Victoria, and UC. No. 38, from California, appeared suitable for mechanical harvesting.

BEANS

Breeding.—At Hawkesbury Agricultural College further progress was made in breeding for disease resistance in string and stringless French beans. Anthracnose-resistance was tested by artificial inoculation in the glasshouse, and rust-resistance was assessed in the field. Check-testing for rust-reaction was done by the Biology Branch, Division of Science Services, on 34 varieties, using a wide range of rust strains.

In the spring and autumn trials 144 lines were under test. The lines included varieties, fixed crossbreds, and breeding material in the F6 to F10 generation. All of these have been screened for resistance to anthracnose Race 1 and are at least field-tolerant to rust. Two lines have shown outstanding promise as stringless market-types. Several selections from a cross now in the F7 generation offer good potential for processing. In addition to their disease resistance, they have upright growth habit and rounded stringless, fibreless pods. These qualities and their slow development of seed recommend them for canning and deep-freezing.

Of the string-varieties, three selections from a cross that includes Cornell 49–242 as a parent are highly promising. Cornell 49–242 is a semi-wild bean, native to South America, which has multiple disease-resistance.

Activities at the Yanco Research Station were confined to maintenance of breeding-lines and some selection-work including bulk-selection of pole stringless-lines.

Root-Rot Complex.—A root-rotting disease, cause still obscure, again caused concern to processors and western growers. It was recorded also in coastal areas this season. It has posed a serious problem for the expanding deep-freeze industry.

Four varieties evolved at the Yanco Station were grown for observation and seed-increase by seedsmen and processors. These varieties are Bland, Turon, Yanco, and Leeton. Their resistance to the root-rot complex was confirmed but there is some doubt of their processing-quality. Bland appears to be best in that respect.

Manganese-Toxicity Trial.—A manganese-toxicity trial was conducted at Terranora Vegetable Station. Results to date were summarized in an article in the *Agricultural Gazette of N.S.W.*, March, 1966.

Seed Certification.—The acreage submitted for seed-certification increased slightly; from 29 in 1964–65, producing 320 bushels, to 55 in 1965–66, producing 400 bushels. The main value of certification is the provision of mother-seed of disease-free history rather than direct contribution to the seed-requirements of green-bean growers.

Lima Beans.—In N.S.W., lima beans have been shy bearers. It has been difficult even to maintain seed stocks. Local production of lima beans could overcome the need for imports. Therefore, trial plantings have been made at the Glen Innes Agricultural Research Station in recent years. In the past season the project was extended to the Orange Research Station.

Two lines segregating for short- and long-day blooming-habit were introduced from the United States Department of Agriculture. These are under observation at the two Stations. Obvious differences in maturity have been noted but whether this is due to reaction to day-length has not been established. Single-plant selections have been made, to elucidate this point and to develop varieties which will set seed freely.

PEAS

Improvement Work.—Five fixed-crossbred lines were trialled at Hawkesbury Agricultural College. Their produce was subjected to canning and quick-freezing tests. Two fixed lines from the cross Early Wonder x Canner 75 and one from the cross Alaska x Greenfeast outyielded the standard variety Small Sieve Freezer. Their processed produce compared favourably with the control variety.

Breeding at the Yanco Station has been discontinued, because the local cannery has discontinued handling peas. But the three varieties named and released last year were seed-increased.

ROCKMELONS

Improvement Work.—At two sites in the Griffith district, 15 selected crossbreds in the F6 and F7 generations were tested. These selections had been screened for resistance to *Fusarium*-wilt. Eight of the crossbreds were virtually immune to powdery mildew and five others showed high field-resistance. A crop surrounding the trial was severely infected.

Resistance to powdery mildew in most of the crossbreds was obtained from an Oriental melon, quite different in type to that required by N.S.W. consumers. Most of the lines under test were of good commercial-type and size, and their yields were satisfactory.

At the Yanco Station some selection was done in crossbreds in the F6 to F8 generations. These lines have been developed for resistance to *Fusarium* and powdery mildew.

ASPARAGUS

The Asparagus Experiment Planning Committee representative of the Department, the Rural Bank, and the Batlow Packing House Co-operative Ltd continued to supervise research in association with the Gundagai Asparagus Co-operative.

The rotation-trial continued to provide hope that asparagus can be re-established soon after the removal of an old asparagus bed. This is important because there are extensive areas of asparagus in N.S.W. reaching the limit of their productive life.

CAPSICUMS

At Hawkesbury Agricultural College further selections were made within segregating lines of capsicums, to improve the yield and shape of dark- and medium-green conical varieties. Attention to capsicum improvement has been justified by the increasing popularity of this vegetable.

DIVISION OF HORTICULTURE

Research for the Fruit Industries

RESEARCH—CITRUS INDUSTRIES

Rootstocks.—Citrange rootstocks, Carrizo and Troyer, continued to show promise in the trials. On the central coast, at Somersby, Troyer is very promising in new land, with Valencia as scion.

Rough lemon has done well in all districts on new land, where *Phytophthora* root rot is not a problem.

Sweet orange stocks maintained their prominence in the sandy soils at Dareton, and promise well in the lighter soils of the expansion area at the Yanco Agricultural College and Research Station. Sweet orange, like rough lemon in regard to *Phytophthora*-susceptibility, is affected by an additional, unknown factor on the coast. There the growth and performance of trees on sweet orange rootstock have been very erratic.

Trifoliata continued to do well under coastal conditions, and in heavier soils in the Murray and Murrumbidgee Irrigation Areas. But this stock lacks the vigour of rough lemon and sweet orange when grown on light soils in the latter areas. It has remained superior as a replant stock in all areas, although the full potential of the citranges for that purpose has yet to be determined.

Rough lemon remained the best stock for Eureka lemons, although the mandarin stocks, Scarlet, Cleopatra, and Emperor, all slightly more resistant to *Phytophthora*, showed promise and may be the better in particular situations.

Dwarf Trees.—Trials have been established to examine the production and culture of dwarf orange trees on trifoliata rootstock. They indicate that dwarfness can be transmitted by bud inoculation at various growth stages of young trees. This is being further studied in a trial initiated this year on an orchard at Pomona, near Wentworth.

Other trials investigating dwarfing include:

(i) Selection of the most suitable dwarfing-budline inoculants for use on several scion selections.
(ii) Suitability of various rootstocks for induced-dwarfing.
(iii) Orchard management of dwarf trees closely-planted, compared with that of trees normally-spaced and sized.

Close Planting.—In a trial planted in 1960 at the Horticultural Research Station, Dareton, double-planted Valencia orange trees slightly outyielded for the second consecutive year the normally-spaced trees, on a single tree basis. The coming crop shows signs of slightly higher yields *per tree* from the normally-spaced trees, but the total *per acre* crop from double-planted trees will be almost twice as great.

Herbicides in Orchard Management.—The recently concluded herbicide evaluation project has been replaced at Dareton by a new one—concerned with chemical weed-control in orchard management.

This new trial includes a pre-emergent herbicide to replace cultivation in various management systems. The systems on trial are:

(i) Summer herbicide plus winter herbicide.
(ii) Summer herbicide plus winter cover crop.
(iii) Clean summer cultivation plus winter cover crop.

The project may show the effect of the herbicide, management system on irrigation penetration and run-off, growth of cover crops, and incorporation of fertilizers, amongst other findings.

Fruit-fly Commodity-treatment.—Investigations of ethylene dibromide fumigation of lemons, mandarins and grapefruit continued at the Citrus Wastage Research Laboratory, Gosford. Larval-mortality studies with Eureka lemons fumigated at 70°F. resulted in 11,059 larvae killed, and no survivors, at a dose rate of 14 oz EDB/1,000 cu ft, and 10,260 killed with no survivors, at the 18 oz dose rate.

As in 1964, rind-injury to Ellendale mandarins was significant with the EDB doses studied, especially at lower fumigation temperatures, but at 70°F. was generally not severe. Fruit from some orchards was more susceptible than others.

Marsh grapefruit showed no rind injury from 70°F. fumigation at EDB doses up to 14 oz/1,000 cu ft, although in previous years rind injury occurred at dose rates that are standard for oranges.

Mould Wastage.—Further wastage experiments, with diphenyl impregnated wraps, confirmed that 25–35 mg diphenyl per 100 sq in wrap is the optimum level of diphenyl in oiled wraps for control of *Penicillium* mould wastage in oranges. Higher diphenyl levels did not appreciably increase the effectiveness but resulted in high diphenyl residues in the treated fruit. These in some instances exceeded the residue-tolerances established by various overseas countries.

In rind-injury experiments, wraps impregnated with the acetate and isobutyrate esters of ortho-phenylphenol caused significant injury at a concentration of 50 mg per 100 sq in wrap. However, the esters effectively control mould at lower concentrations without injury.

A new dip fungicide, 2- amino butane (2-ab) has shown great promise for control of mould wastage in citrus. Used as an acetate formulation, 2-ab gave comparable results to SOPP in several trials, in solutions or in water-wax emulsion. More extensive trials are continuing. These include examination of combined 2-ab and SOPP treatments.

RESEARCH—POME FRUIT INDUSTRIES

Rootstocks.—The rootstock trials planted in recent years at Bathurst and Glen Innes Agricultural Research Stations and Yanco Agricultural College and Research Station have progressed well, despite the dry Bathurst and Glen Innes conditions of the past two years. At Yanco, the first commercial crop from the Granny Smith rootstock trial has now been harvested. The cropping-superiority, at least at this early stage, of the semi-dwarfing rootstocks compared with the more vigorous stocks is clear.

Chemical Weed Control.—At Armidale, in a small trial, herbicides have been used around 3-year-old apple trees. The chemicals were applied to bare soil and they prevented weed-growth for at least three months after good rains in December. No damage was observed.

At Bathurst Agricultural Research Station a trial was initiated to determine the tolerance of aged apple trees to high concentrations of four herbicides. This is in collaboraiton with Division of Plant Industry. The effect so far has included leaf-scorching, chlorosis, and premature leaf-fall, at relatively low concentrations, but the drought conditions may have contributed.

Fruit Tree Decline.—In recent years there have been instances of mild to severe die-back of apple and pear trees at Orange and Batlow. The prime cause has seemed to be root-injury, restricting the tree's take-up of moisture and nutrients. In non-irrigated orchards the severe drought has aggravated this.

Two exploratory trials have been started at Orange to assess tree-response to possible remedial treatments and to gain further physiological and nutritional information.

Breakdown in Apples in Cool Store.—Under conditions of high relative humidity, as in polyethylene bags, weight-loss from apples is minimized and, unless the oxygen level is relatively low, the susceptible lines of fruit suffer severe breakdown. A quantitative relationship between weight loss and breakdown has been shown. This season a cool room running at low relative humidity is being used in a trial to induce a high rate of evaporation during the early part of the storage season, to assess this as a possible commercial control.

Nutrition in Relation to Fruit Quality.—Injection of solid nutrients containing nitrogen, phosphorus and potassium into Jonathan apple trees at Bathurst Agricultural Research Station has not affected storage behaviour. Chemical analyses of the fruit and leaves have not shown any increase in nutrient contents. This has raised the question as to where the large doses of nutrients have accumulated. To answer the question, several of the trees are to be removed for analyses of various parts—especially the roots.

RESEARCH—GRAPE INDUSTRIES

Folair Sprays and Fruit Set.—In experiments at Griffith Viticultural Research Station, concentrations of 300–1,200p.p.m. of the growth-retardant hormone C.C.C., applied to Gordo Blanco vines before and after bloom, failed to improve set or decrease berry-size as reported by workers elsewhere.

Concentrations of 600 p.p.m. of C.C.C. applied at the commencement of bloom, and 10–20 p.p.m. of Gibberellic Acid (G.A.) applied immediately after shatter, significantly increased the percentage of seedless berries from 25 per cent (untreated) to 45 per cent (10 p.p.m. G.A.) and to 75 per cent (20 p.p.m. G.A.). The 600 p.p.m. of C.C.C. applied at commencement of bloom, and 5 p.p.m. of G.A. applied either before or after shatter, did not affect seed content.

It is likely that the increased seedlessness was caused by G.A. alone. Pilot trials with G.A. at Coomealla showed that application at shatter greatly increased seedlessness of Waltham Cross.

Variety Identification Key.—During 1966 a key for the identification of vine varieties currently grown in the M.I.A. was devised. Research staff of the Viticultural Research Station, Griffith have found this key satisfactory but intense field testing has yet to be done by independent observers.

The key is only suitable when the vine is carrying mature fruit. Characteristics used are colour, shape of berries, seed shape and content, colour of petiole, degree of hairiness of the under surface of leaf, peduncle length, leaf lobation ratio and bunch size.

Weed Control for Newly Planted Vines.—At Griffith, Cornichon vines where weeds were not controlled in the year of planting (1963–64), but kept weed-free in subsequent years, are still showing the effects of weed competition in their first year. Pruning weights of unweeded plots were 47 per cent and yields 80 per cent of the chipped control-plots. Plots treated with Simazine (4 lb per acre) in their first year gave pruning weights 73 per cent and yields 90 per cent of the chipped control.

Pruning, Training and Spacing.—In 1962, plantings were made in permanent experiments at the Viticultural Research Station, Griffith, to investigate the effects of different pruning, training and spacing treatments on yield and quality of Black Shiraz, Semillon, and Gordo Blanco wine grapes. Not all of the pruning treatments have yet been commenced, but the experiments are already yielding useful data, as follows:

(i) *Black Shiraz*: In their first two crops, vines trained on a "T" trellis have yielded a cumulative total of 60 lb per vine compared with 47 lb per vine on standard single-wire trellis. Rod-pruning (Sultana method) which was commenced in 1965–66, increased yield by 33 per cent on the "T" trellis, and by 18 per cent on the standard single-wire trellis, compared with normal spur-pruning. There was no difference in sugar content or titrateable acidity.

(ii) *Semillon*: In the past two seasons Semillon vines pruned to spurs have yielded a cumulative total of 63 lb per vine on "T" trellis as compared with a 52 lb per vine on standard single-wire trellis. Rod-pruning in 1965–66 did not give greater yields than spur-pruning but decreased the sugar content and increased the titrateable acidity.

(iii) *Gordo Blanco*: Besides pruning and training, 4 ft and 7 ft spacings in the row are being compared. In 1964–65, yields on per acre basis were 60 per cent greater at 4 ft spacings than at 7 ft spacings, on "T" trellis, and 70 per cent greater at the closing spacing on the standard single-wire trellis.

In 1965–66, competition between vines planted 4 ft apart became more intense and the yield advantage was reduced to 30 per cent on the "T" trellis and 15 per cent on the standard single-wire trellis. Yield per vine on each trellising system was greater under 7 ft spacings.

In 1964–65, yields on "T" trellis at each spacing were slightly lower than on single-wire trellis. This was reversed in 1965–66. The lower yields earlier on "T" trellis can be attributed to the low vigour of the variety, allowing only slow formation of the main arms on "T" trellis.

Gibberellic Acid (G.A.) on Sultanas for Size.—At Dareton, experiments with G.A. sprays to increase the size of Sultana table grapes continued. The 1965–66 results confirmed those of the previous year and gave added information about the correct timing of sprays, concentrations, etc.

This work has shown that berry size *and* yields of Sultanas can be greatly increased by the use of G.A. The results are being prepared for publication.

Table Grape Export Experiments.—Experiments were conducted in 1966 to define the shipping life of export table grapes. They have shown that the export markets for at least some varieties can be extended. The varieties involved were Waltham Cross, Gordo Blanco and Purple Cornichon. Shipping life was tested in several different packs. Of these, the standard pack of granulated cork and metabisulphite was best, and highly significantly so. Packs using bunch-wraps impregnated with SOPP, and packs with pads impregnated with SOPP and metabisulphite, also showed promise.

RESEARCH—TROPICAL FRUIT INDUSTRIES

Post-harvest Handling of Bananas.—At the Tropical Fruit Research Station, Alstonville, there has been work to obtain basic data relative to the mixed-ripe problem with bananas.

The studies have shown that top hands, with their heavier and longer fruits, tend to ripen first—although fruit circumference is relatively uniform throughout the bunch as compared with fruit weight.

The interval between bunch emergence and bunch harvest is dependent on the date of emergence and subsequent seasonal conditions, but optimum harvest times for mixed-ripe control are likely to be based on a knowledge of bunch age and fruit size. Circumference changes of fruit have been shown to be closely related to fresh-weight changes and appear to be the simplest way of measuring changes in fruit size.

A trial to examine the long-term effects of harvesting bunches at earlier stages of maturity has been initiated.

In studies of packaging and handling, transit-simulation equipment has been used. It was necessary to characterize the vibrator movement to give consistent results, measurement of acceleration being important. Preliminary results with pre-cooling suggest that rate of metabolism of the bananas at 40°F is very low, but pre-cooling down to 40°F could proceed under current transport conditions without injury.

Banana Nutrition.—The "Banana Decline" disorder prevents proper development of banana plants and bunches in the cooler period of the year. It is suspected to be a complex nutritional problem wherein potassium and magnesium have alleviating roles. Investigations are proceeding.

The major nutritional trial at the Alstonville Station has given much information on experimental methods and the relationship between climate and plant growth. But the effects of the major nutrients on plant growth and development have not been clear. Natural fertility gradients in the soil seem to have masked a fertilizer response so far.

A trial to determine the most satisfactory sampling method for measuring nutrient levels in banana plants has been started.

Transport of Bananas in Polyethylene Bags.—In laboratory experiments at the Food Preservation Research Laboratories, North Ryde, an extension of about one week in the green life of bananas was readily obtained by packing the fruit in polyethylene bags after harvest. Further work has indicated that packing partially ripe fruit with the green fruit does not induce the latter to ripen. In the past summer, 10 commercial shipments of bananas, some in polyethylene bags and some not, were forwarded to Sydney from three north coast centres. After three to four days in commercial ripening rooms the fruit in polyethylene bags remained hard and green, but on removal of the bags and return to the ripening-rooms the fruit ripened normally after three to four more days. This method could be of major value to overcome the mixed-ripe problem. Further studies are in progress.

Pineapple Research.—Investigations with flower induction of pineapples suggest that a more even fruiting period as well as increased fruiting can be obtained.

In tests of types of planting material, large and small suckers, large and small slips, and tops are all included, and in addition varying planting distances are being assessed.

RESEARCH—STONE FRUIT INDUSTRIES

Dessert Peaches, Variety Improvement.—A succession of unusually late frosts destroyed the entire peach crop in the trial plantings of new varieties at Bathurst Agricultural Research Station. A few fruit were obtained from some of the new ones at the Narara Station.

The varieties Starking Delicious, Redhaven, and Fragar, all tested by the Department in recent years, are becoming popular with commercial growers.

Canning Peaches, Variety Improvement.—Useful cropping information is coming from recently planted variety trials at the Yanco Station, and samples from all varieties have been processed for canning-quality tests.

Trees of other varieties, recently introduced from South Africa and the U.S.A., have been propagated and are now available for the trial areas.

Seedlings arising from the breeding programme have been planted out for observation.

Apricots, Variety Improvement.—The Morocco apricot continued to perform well. It is outstanding, consistently producing greater yields than the standard Trevatt. Further canning-quality assessments are needed before large-scale plantings can be recommended.

Cherries, Variety Improvement.—In variety trials at Orange and Young the variety Regina, bred by this Department, was outstanding for fruit quality—even under severe drought conditions at Young—and the variety resisted splitting. Merton Heart produced good quality fruit but cropped lightly.

Rootstocks for Apricots.—A trial of apricot on plum, peach, and apricot rootstocks has produced unusual results—the trees on apricot seedling stocks have been outgrown by trees on the other stocks. The results oppose those of most previous trials and the reasons are to be sought.

The best trees in the trial are those of Buck plum rootstock and further testing of the value of this stock for apricots has been planned.

Rootstocks for Prunes.—Prunes in all districts continue to make outstanding growth on Buck plum rootstock, although the fruit are usually small. In the drought conditions at Young the trees of Buck plum produced the lowest yields.

Rootstocks for Cherries.—Trials are demonstrating that the Malling F12/1 and Deister seedling stocks each resist bacterial canker. The stocks were introduced for this resistance but it has been generally conceded that they should be vegetatively propagated to retain the resistance. To test this, virus-free material has been planted to establish stool beds for comparisons of vegetatively-raised stock and seedling material.

Nutrition and Fertilizers.—Anhydrous ammonia as a fertilizer for canning-peaches is being investigated at the Yanco Station. In a comparison with calcium ammonium nitrate, the early results suggest anhydrous ammonia is a satisfactory nitrogen source for peach trees.

In a prune nutrition trial, started at Young in 1958, complete fertilizer including potash has continued to produce greater yields than do nitrogen and phosphate only. Further increases have been obtained by adding magnesium carbonate to the NPK mixture.

Pre-packaging Cherries.—Experiments at Young and Orange examined the effect of pre-packaging techniques on cherries' post-harvest behaviour. Cherries were packed in cardboard punnets, enclosed in 0.0015 inch polyethylene film to regulate the atmosphere in the package—to provide longer shelf-life and reduce fungal wastage. The packaged fruit was transported to constant temperature rooms at the Food Preservation Research Laboratories, North Ryde. Some treatments included a fungicide impregnated in wraps within the packages.

The treatments reduced post-harvest rots but not to an acceptable commercial level. Further investigations are contemplated for next season.

RESEARCH—STRAWBERRY INDUSTRY

Strawberry Improvement.—Breeding, selection, and preliminary testing of promising material continued at Narara Horticultural Research Station.

A field trial established there this season is comparing four named varieties introduced from overseas and the local variety Kendall and eight promising local hybrids. The previous year's field trial has been retained for further observation.

In the breeding section, 2,274 hybrids from 35 crosses were set out for selection. The parents are introduced varieties and local selections. Seven of the most promising selections made in 1966, and six from 1965, have been set out in 20-plant plots for critical observations.

A new seed-storage method was developed this year. Together with soil sterilization it resulted in remarkably high germination, and vigorous growth of seedlings.

District trial plots for more promising varieties and selections have been established at Glen Innes, Orange, Parramatta, and Gosford. Red Gauntlet has been producing outstanding yields at Glen Innes.

PROPAGATION OF NUT TREES

A nut tree propagation project has been initiated at the Horticultural Research Station, Narara, using a seed grafting technique recently developed in the U.S.A. Preliminary trials have already given promising results with Macadamia nut propagation. It is planned to include Pecan nut and Walnut propagation in this investigation.

TILE DRAINAGE RESEARCH

Depth and Spacing.—No critical water-table conditions existed in the tile drainage Depth and Spacing Trial at the Griffith Research Station this year and, so, no apparent response to the various depth and spacing treatments. However, high salinity of drainage effluent was associated with reduced plant vigour.

Reduced vegetative vigour of Doradillo vines appears to be associated with the extremely heavy yields of the past season.

Water usage by peach trees was again higher than by vines. The latter in turn were considerably higher in water usage than were young double planted citrus.

Lysimeter Studies.—Peach trees growing in lysimeters of 30 cubic feet capacity, and subject to a water table one foot below the soil surface between 7/3/66 and 4/4/66, suffered considerable injury from waterlogging. Over the same period, similar trees subjected to a surface water table for 72 hours at two to three week intervals showed no obvious stress, but made less girth development than trees subjected to a three feet water table over the same period or trees allowed unrestricted drainage.

Drain Blockage.—Tile-line root-blockage investigations indicated that pentachlorphenol incorporated in a narrow band at least two feet below the soil surface failed to stop the passage of peach roots or adversely affect the growth of peach seedlings.

Research Stations and Laboratories

Bathurst Agricultural Research Station.—A peach rootstock trial was established, and peach plantings to provide for short-term trials and fruit for post-harvest work were extended.

A hydro-cooling unit was installed to test hydro-cooling for maintenance of fruit condition of peaches—from the orchard to the consumer.

An irrigation system was installed, for water reticulation throughout the orchard. Water supplies will be enough to irrigate trial areas at critical times and for some irrigation investigations.

Research equipment was added for study of soil moisture and plant growth relationships.

Orange Agricultural Research Station.—Towards initiation of horticultural research at this new Station, soil survey results have been examined before deciding on areas for fruit plantings.

Yanco Agricultural College and Research Station.—A *Phytophthora*-resistant rootstock trial for citrus (240 trees) was planted in the extension area and overhead sprinkler irrigation installed. The trial will compare the compatibility of four scion types (Ellendale and Emperor mandarins, Valencia oranges, and Eureka lemons) on nine trifoliata hybrid rootstocks.

More peach varieties were planted in the arboretum area and some areas of older trees not now needed for research were removed.

The fruit grader was improved, to handle better the peach crop. Research equipment was increased.

Gosford Citrus Wastage Research Laboratory.—The laboratory, co-operative with the CSIRO Division of Food Preservation, continued to investigate citrus preservation and storage and fruit-fly sterilization in citrus.

New projects initiated for the 1966–67 season include investigation of de-greening of early mandarin varieties, and application of SOPP and wax to mandarins.

North Ryde Fruit Preservation Research Laboratory.—Cool storage investigations on fruit are conducted here in co-operation with the CSIRO Division of Food Preservation. A commercial firm was helped in testing the value of externally generated controlled atmospheres in cool stores.

Dareton Horticultural Research Station.—Two and a half acres of virgin land have been cleared. Spray irrigation was installed in the area intended for rootstock-investigations and Gordo Blanco clonal-selection work. Also, about 25 acres were cleared on the southwest corner, grid-surveyed for soil uniformity, and found suitable for the proposed citrus nutrition trial and an avocado planting.

The replacement of the 1 cusec pump by a 2 cusec unit, installation of a 2 cusec drainage system to handle pump overflow, and the tile and surface drainage, now permits expansion of citrus research.

A hotbed was constructed and is being used to raise avocado seedlings in the winter for spring propagation.

Narara Horticultural Research Station.—A comprehensive collection of seed and budwood of the Australian Native limes *Microcitrus australis* and *australasica* was made. An eventual field planting of this material is proposed. *Microcitrus* spp. have potential as parents in breeding for resistance to *Phytophthora* root rot.

The strawberry research and variety testing area was further developed. The glasshouse and the shade shed now provide better for strawberry breeding. A soil sterilization unit has been obtained, and amply provided sterilized soil for germination of seedlings from the crosses.

More planting space is to be secured, by ringbarking virgin scrub at Somersby and re-opening an old orchard area at Narara. The latter involves construction of an access road, and some clearing.

Alstonville Tropical Fruit Research Station.—The pumping unit on Maguire's Creek and the dam on the Station have been completed. Tenders have been called for the first stage of reticulation.

Plantings of selected pineapple clones and avocado varieties have been added; also, small plantings of bananas in isolation blocks here and at Wollongbar Agricultural Research Station.

A glasshouse has been erected. Research equipment has been increased.

Griffith Viticultural Research Station.—Grading was completed on a further 10 acres, for 1967 extension of wine grape variety trials. Irrigation installations are proceedings in the area. Lucerne was established on 15 acres of new land as a temporary reclaimer.

Permanent experiments planted in recent years have made good progress. Isolated areas of sodium-affected soils have responded to gypsum.

A permanent 4 acres of Black Shiraz wine graps planted in 1963 has developed well. These vines are for a major investigation into wine grapes irrigation. First treatments will be applied in 1966–67.

Spray irrigation was installed in the non-gravitational area where there are several citrus projects.

Grading equipment was installed, including electronic counters for the various size ranges, and yielded required production data.

Committees Affecting Research

Co-ordination of Fruit and Vegetable Processing Research.—This committee met twice this year. It comprises representatives of the CSIRO, Department of Agriculture, and the canning industry. It reviewed progress of current investigations, and planned future work. Under attention were breakdown of apricots; apple canning in Tasmania; canning of berry fruits in Tasmania; freezing of strawberries; storage of moist and dry pack apricots; and packaging of high moisture-content prunes.

Deciduous Fruit Tree Improvement.—This committee comprising officers of the Division of Horticulture and the Biology Branch of Division of Science Services aims, by selection of propagating material, to prevent the spread of virus diseases in deciduous fruit trees.

A wider range of virus-indexing plants has been collected. Testing of cherries, apples and plums is proceeding. Building up of sources of proved virus-free material has progressed.

By close co-operation with the N.S.W. Nurserymen's Association the committee has been able to ensure that most deciduous trees in N.S.W. are propagated from approved parent sources, although selection so far has been mainly on apparent visual freedom from the virus diseases.

Fruit Cool Storage Investigation in N.S.W.—The advisory committee met this year to consider the results and projected programmes of fruit storage, citrus wastage and plant physiology investigations being done by the University of Sydney, CSIRO Division of Food Preservation, and this Department. Each of these parties is represented in the Committee.

Citrus Wastage Research.—The committee, comprising representatives of this Department and the CSIRO Division of Food Preservation, directs research on post-harvest problems of citrus and operates as a sub-committee of the Advisory Committee on Fruit Cool Storage Investigations in N.S.W. It met twice this year to discuss projects and plan the research programme.

Murray Citrus.—This is a sub-committee of the Commonwealth Co-ordination Committee for Fruit and Vegetable Storage Research, and met during the year. It comprises representatives from Departments of Agriculture of Victoria, South Australia and New South Wales, and the CSIRO Division of Food Preservation. It co-ordinates, as between the States, research on the post-harvest treatment of citrus—storage, fungicidal processing treatments, and shed handling.

Fruit Fly Commodity Treatment.—Representatives of the Department of Primary Industry, the CSIRO, the Departments of Agriculture of Victoria, South Australia, and New South Wales, and the Queensland Department of Primary Industries, comprise this Committee. They met once this year. The Committee directs investigations into post-harvest sterilization of citrus and certain pome fruit, against Queensland Fruit Fly. The Committee agreed that evidence obtained warrants recommendation of EDB fumigation of lemons, similar to that for oranges. It also agreed to incorporate recommendations for fumigation of mandarins, although acknowledging some risk of rind injury to the Ellendale variety. A report summarizing pear cold-storage sterilization-investigations, has been prepared for consideration by U.S.A. authorities.

N.S.W. Citrus Juice Quality Investigation.—Represented in this committee are the CSIRO, M.I.A. Irrigation Research and Extension Committee, the N.S.W. Citrus Growers' Council, and this Department. The committee has decided to concentrate, over the next few years, on fruit sampling from trees of known origin on Departmental orchards at Dareton, Yanco and Gosford, to examine the effects of scion, rootstock and climate on juice bitterness.

Citrus Improvement.—This intra-Departmental Committee met twice this year. It directs research into the influence of virus diseases on tree health, the suitabilities of rootstocks, and scion-rootstock relationships. "Dwarfness" in association with close planting, and protection of grapefruit from severe stem-pit by mild-strain protection, continued to be special-interest projects.

M.I.A. Irrigation Research and Extension.—Co-ordination of agricultural research and extension activities of special interest to the M.I.A. is the main aim of this Irrigation Research and Extension Committee (I.R.E.C.). It meets twice yearly. In the committee are representatives of this Department, other Government bodies, financial organizations, grower and industry representatives. Publication of the M.I.A. Newsletter continued as a major extension activity.

Central Coast Agricultural Research and Extension.—This Committee is interested in agricultural research and extension in the central coast (Gosford-Wyong) area of New South Wales. The Department is represented in the committee, with other Departments and some financial, grower, and industry bodies. The committee, with objects similar to those of the I.R.E.C., publishes a rural newsletter.

CSIRO Vine Improvement Research.—The committee was formed by the Horticultural Research Section of the CSIRO in 1965, to advise and assist in the CSIRO grape research programme. It includes representatives from State Departments of Agriculture, the Australian Wine Research Institute, Federal Grapegrowers Council, and Australian Dried Fruits Association. Two meetings were held this year at Merbein. Arrangements were made for orderly distribution of high yielding sultana clones to grape growers, and for nation-wide collection of phenological data for grapes. State Departments of Agriculture are actively in this work.

Dried Fruits Processing.—The regular annual meeting of the Commonwealth Dried Fruits Processing Committee was held at Melbourne in November, 1965. The committee is representative of all organizations concerned with research into dried fruits processing, including State Departments of Agriculture and the CSIRO. Matters under attention at the 1965 meeting included publication of the *Drying of Grapes* extension bulletin and research into sulphuring of tree fruits, sun-drying of sultanas, parallel-flow dehydration of prunes, white centres in dried apricots, prune maturity investigations, and structure and composition of the wax cuticle on sultanas.

Apple and Pear Spray Residue.—This committee comprises representatives from the Commonwealth Department of Primary Industry, the CSIRO, and the Victorian, Tasmanian, and New South Wales Departments of Agriculture. Its objectives relate to spray residues on apples and pears and the changing requirements of importing countries. Because of difficulties in removing some spray residues by washing, a special wet and dry processing unit has been installed at the Bathurst Agricultural Research Station for the committee's satisfaction.

Banana Research.—This advisory committee met to review progress on banana post-harvest investigations, and to recommend the allocations of funds contributed by the Australian Banana Growers Council and the Commonwealth Government. The Commonwealth Department of Primary Industry, the CSIRO, and the States of Queensland and New South Wales are represented in it.

Horticultural Research Review.—Research programmes of the Division of Horticulture research officers were reviewed during the year by a committee of senior officers of the Division. The reviews were comprehensive and benefits from the committee's activities are accruing.

Fruit Industry Trends

GENERAL

Market-quality High, Despite Drought.—The 1965–66 production year has undoubtedly been seriously affected by drought, with associated tree losses and reduced production. Notwithstanding those disastrous effects, the fruit at the city markets has been of general high standard.

Allegations of interstate dumping and anticipation of a glut of small fruit have been expressed, but in fact not substantiated by the number and nature of downgrading certificates issued this year. The inspector service, as now provided for the city markets constitutes an increase from an average of 1.5 men per day to over eight but there has been no notable increase in rejections.

Needs.—The overall impression is one of full production and, for pome fruits, the possibility of over-production. But it is generally accepted that the margin between grower and consumer is too wide, and that there is room for increased consumption with commensurate return to the producer.

There is a continuing need for further research and extension activities in the production field, but an equal need for investigations into problems of distribution—with due regard for presentation, storage and marketing.

Increased demand for export, e.g., bananas to New Zealand, citrus to Japan, and apples to Great Britain, suggests the need to expand in this direction. The expansion would in part reflect the results of the Division of Horticulture activities on better presentation, commodity treatment, and control of fruit fly.

While export markets appear to be relatively untapped and likely to develop as a result of the fruit-fly control activities, the living standards of most Australians are sufficient to accommodate a greater intake of fresh fruit. Local markets could absorb the anticipated production if proper attention is given to fruit quality and efficient distribution.

CITRUS INDUSTRY TRENDS

Production and Returns.—The estimated overall production has been 4,640,000 cases of citrus fruits. It has emphasized the need for sound distribution, with accent upon export from inland areas. Overall prices appear to have been relatively stable and generally better for the average producer.

Export Lower.—Frost damage affected the quantity of fruits submitted for export. Only 6,000 cases went forward from the Mid-Murray and 47,144 cases (mainly M.I.A.) from Sydney, but an estimated 182,000 cases were submitted from the Lower Murray for export—to such countries as Canada, New Zealand, France, Singapore, and Manilla.

Citrus Juicing.—Conversely, the Mid-Murray, M.I.A., and central coast districts all reported increased interest in juice production. For example, one Gosford processor now sends to Sydney an average of 4,000 gallons of fresh juice each week, by road tanker, and intends to establish a second factory at Leeton to supplement this supply.

Lemon production fell short of processors' needs. Juice imports were permitted, to alleviate the shortage of local supplies.

GRAPE INDUSTRY TRENDS

Wine Grapes—Increasing Production.—The area of wine grapes in New South Wales has increased by 313 acres since 1964, and two-thirds of the increase has been in the M.I.A.

Assuming a yield average of 7.6 tons per acre, and with no further plantings in the M.I.A., production could be expected to rise to 42,500 tons by 1968 as compared to the 1965 record of 40,228 tons. Wineries would have difficulty in handling this quantity unless their capacity were increased meantime.

Greater productivity in the M.I.A. with Doradillo and Semillon varieties, respectively averaging 9 and 8.8 tons per acre, reflects improved cultural practices and tile drainage.

Dried Vine Fruits—Reducing Production.—Despite improved marketing for dried vine fruits, and industry adoption of a stabilization plan, the non-bearing area of drying grapes has fallen from 4.2 per cent of the total in 1964 to 1.8 per cent of the total in 1965. This is not enough to maintain the existing area.

Following the poor currant-harvest this year, many growers have removed their vines and are replanting with Sultanas. Next year there will be a much reduced currant crop, because of the small remaining acreage.

Sultana, the State's most important grape variety, now has 6,902 acres; 300 more than was shown by 1964 census figures.

As about 80 per cent of Australia's dried vine fruit has to be sold on the export market, most sections of the industry are against any significant expansion in the area of drying grapes. It is likely that future plantings will be confined to small private-irrigation schemes and to replacement of old vines.

Table Grapes.—Table grape production in N.S.W. for 1965–66 is estimated at 8,000 tons. The record crop was 8,251 tons in 1964–65. Seasonal conditions were generally favourable throughout the State. Rain near the maturity period caused some losses in irrigation districts, and berry-size was affected by drought in non-irrigated areas.

In the M.I.A., production of table grapes was 374,737 half-bushel cases, compared to 305,688 half-bushel cases in 1964–65; 5,046 cases were exported.

Consignments of sultanas to market substantially increased. Growers are showing much more interest in presentation and also paid more attention to the prescribed maturity standards.

Use of Gibberellic acid to improve berry-size in sultanas was more widespread, and is expected to increase in the coming season.

POME FRUIT INDUSTRY TRENDS

Planting Trends.—Planting in the main commercial areas has eased, but this has been more than offset by continued heavy plantings near to Sydney by city business and professional men.

Cool-storage varieties continued to be favoured in the main highland areas. Granny Smiths for export continued to be favoured in the M.I.A. and at Forbes. Heavy plantings of Jonathans in the near coastal areas (particularly at Bilpin) could pose a marketing problem in a few years' time because of increasing supplies from Queensland.

Estimated Production.—Production was estimated at 2,740,000 bushel cases of applies and 600,000 cases of pears; very satisfactory in view of the heavy crop carried forward from the previous year, the continuing drought and the effect of frost at blossom time throughout the Bathurst and Young and part of the Orange districts.

Some significant figures are that although some two-thirds of the trees in the Bilpin area are either non-bearing or so young as to be light bearing, the estimated production was over 200,000 bushels. It is significant also that some Willigobung settlers produced up to 12,000 cases.

Production Increasing.—During the past decade, the production of pome fruits has increased by about 100 per cent, mainly due to improved cultural factors. Over one-third of the present acreage comprises young trees, so this trend will continue. Adjoining States also report increasing production and will add to the competition on New South Wales markets.

Demand for quality fruit continued, but low grade and small sizes were difficult to dispose of and gave little or no margin over cost of production and marketing.

Exports.—Some 154,513 bushels of apples were exported from the Port of Sydney, about 28,000 bushels less than in the previous year. Most of these apples were shipped to the United Kingdom and the Continent. Small quantities were forwarded to Asian ports and Pacific Islands.

About 23,000 bushels of pears were also consigned overseas, mainly to Pacific Islands and Malaysia.

A feature of the export was predominence of tray-pack cartons.

STONE FRUIT INDUSTRY TRENDS

General.—Mechanical harvesting of prunes, extension in strawberry plantings, and improved market-presentation were the highlight trends. Drought effects at Young, reduced planting rate of canning peaches, and frost damage at Bathurst were debit trends.

Canning Peaches Production Target.—If the production target of 30,000 tons of canning peaches per year by 1973–74 is to be attained, some 400 acres must be planted to canning peaches each year. The figures this year were but 145 acres planted and 19,849 tons produced.

Drought Effect at Young.—Actual losses have yet to be determined. The damage to stone fruit trees in the Young district will affect 1966–67 cherry production. Some of the effect on production will be only temporary, because of the extent of new plantings and the fact that the drought did materially affect the growth of young trees.

TROPICAL FRUIT INDUSTRY TRENDS

Less Banana Acreage.—The area under bananas in New South Wales for 1965–66 was 23,612 acres. New plantings totalled 1,519 acres, and 2,537 acres of unprofitable bananas were destroyed. This reflects a continuing trend toward destroying older, poor-producing plantations, and replacement with young, vigorous plantings to produce good-quality fruits during winter. But plantings are less than destructions. There has been a steady decline from the 29,994 acres under production in 1959–60 to the current 23,612 acres. The latter is the lowest since the 21,663 acres of 1945–46.

Fewer Banana Growers.—The number of growers has also fallen, from 3,305 in 1964–65 to 3,041 in 1965–66. This reflects the elimination of unprofitable plantations and the attraction of other pursuits.

Banana Production.—The estimated production, 3,700,000 bushels, is 400,000 bushels less than in the previous year, mainly due to reduced acreage and adverse weather.

Banana Industry Improvements.—Banana growers are paying more attention to co-operative packing houses, enabling presentation of more uniform lines. There have been advances in export, in use of fibreboard cartons, and in nematode control.

Other Tropicals.—Plantings of tropical fruits other than bananas remained small, but with a slight increase. Advances in the packaging and marketing of avocados and of passion-fruit seem likely to create greater demand and boost consumption.

Extension Services to Fruit Industries

EXTENSION STAFF

Five diplomates from Hawkesbury Agricultural College were recruited to the Division of Horticulture and located at Research Stations for further training, making a total of fourteen officers in training. The extension establishment has two vacancies. These may be filled by recruits from the diploma class of 1966.

Lack of trained officers has made it impossible to fill seven existing district vacancies caused by two resignations, four retirements, and a death. In these circumstances, officers have had to accept additional duties in providing a service for vacant districts.

COMPREHENSIVE RANGE OF MEDIA

Fruit officers made good use of mass meadia, through television, radio, and the press, and of group media, through field days, demonstrations, and schools, as well as individual contacts.

Schools for growers were held at Orange, Windsor, and Batlow, with good attendances.

COMMITTEES ASSISTING EXTENSION

The Division maintained an active role in the M.I.A. Irrigation Research and Extension Committee and its various sub-committees.

The recently formed Central Coast Agricultural Research and Extension Committee was also assisted to good purpose in its formative tasks, and particularly in initiating its Newsletter.

Industry has continued co-operation with the Division in the regional productions of pest and disease control calendars.

A conference of professional officers of the Division was held at Hawkesbury Agricultural College, to discuss research and extension activities.

FRUIT GRADING AND PRESENTATION

The policy of making special efforts towards improved quality and presentation standards has been furthered.

The Fruit Packing Instructor in co-operating with District and market officers conducted twenty-nine packing and grading demonstrations throughout the State, addressed growers' meetings at commercial centres, and conducted a packing school for growers. He also co-authored two new extension publications.

This work on presentation, particularly in relation to tomato grading and packing, has brought inquiries from Argentina and Peking.

Another matter for special mention is the work done in collating information about the multitude of fruit packages in use throughout the Commonwealth; aiming to achieve an acceptable degree of standardization.

FRUIT FLY CONTROL

Whole-town treatment schemes, introduced by the Division of Horticulture for control of fruit fly, gained further momentum. Twenty-three country towns are now co-operating on a voluntary basis. The impressive initial successes have been maintained. Need of supervisory staff is the present limiting factor.

To take full advantage of the break-through in fruit-fly control, regulatory boundaries have been reviewed, new inspectorates have been created, application has been made for allocation of special Extension Grant Funds to help direct attention to fruit-fly control and further demonstrate that the fly can be dealt with by co-ordinated effort.

Regulatory Services—General

GENERAL

Whole-town treatment-schemes for control of fruit fly have continued to develop, within the limitations imposed by number of supervisory staff. Indicative of that is that the officer located at Dubbo is now supervising ten separate schemes. It is significant, too, that the Barham Citrus Growers' Association and the Shire of Berrigan have voluntarily provided those male-lures necessary to cover all of the towns and villages throughout the Mid-Murray area.

Officers located on the north coast report similar success towards control of Bunchy Top and Banana Beetle Borer. And metropolitan and coastal inspectors have progressed with the control of Citrus Gall Wasp.

Action toward closer adherence to the Grading Regulations and improved market presentation has continued. The overall picture appears to show decided improvement. This was illustrated by the drop in grape rejections, from the 40 per cent in 1963–64 to the 6 per cent in 1965–66. Similar success was achieved in curtailing the introduction of interstate potatoes and pumpkins in second-hand sacks. This practice virtually has been eliminated.

Staff problems, particularly in filling country vacancies, have continued to cause administrative difficulties, and the current regulatory structure is being carefully examined.

All inspectorate vacancies have now been filled except Barham, West Wyalong, and Gunnedah. This has been attained only by appointing either new or partly trained officers direct to major commercial areas.

Two metropolitan and one nursery inspector continue to be engaged in suburban inspections.

Demand for metropolitan inspectors appears to have eased, but the services required by nursery production is steadily increasing. This matter is now under review, for formulation of recommendations concerning amalgamation of services.

A relative innovation was the detailing of market inspectors to assist in inspections of metropolitan fruit shops, barrows, and home gardens. This has helped to provide training for junior officers, as well as a better and more regular service for the general metropolitan public.

REGULATORY STAFF ESTABLISHMENT REVIEWED

All country Inspectorates have now been reviewed, and additional Inspectorates have been created at Dareton, Gunnedah, and Bega.

The Bega officer has been temporarily located at West Wyalong to link Narrandera with Dubbo and Gunnedah in an overall plan toward combating fruit fly *and* providing extra protection for the M.I.A.

Action has been started for further development of town-treatment projects for control of fruit fly. It is thought that for this purpose at least three more country Inspectorates will be created.

Two more Plant Quarantine (Timber) positions have been established and action is proceeding for better co-ordination of metropolitan Inspectorates.

PLANT DISEASES AND IRRIGATION (AMENDMENT) ACT, 1924–1962

Plant quarantine powers under the Irrigation Act having been transferred to the Plant Diseases Act, it was possible to provide more effective regulatory powers for Inspectors. This has already been successful against illegal entry of fruits to the M.I.A.

ONION SMUT OUTBREAK AREA QUARANTINED

The disease Onion Smut (*Urocystis cepulae*) not previously recorded in N.S.W. was identified in onion plants from a seedling nursery at Blayney. Onion Smut is only known to have occurred twice previously in Australia. Both occurrences were in South Australia in 1950. It is a very destructive disease, on onions and related plants, particularly in cooler climates.

To prevent spread of this disease, the nursery has been declared a Quarantine Area under the Plant Diseases Act. Soil sterilization treatments will be used to try to destroy the infection.

Regulatory Services—Export and Import Branch

CITY MARKETS AND INTERSTATE SUPPLY INSPECTIONS

Apples.—Much of the 1966 crop was small, due to drought. Where irrigation was available fruit size was good. Many consignments of immature apples were seized and disposed of.

Pears.—Many Victorian growers marketed their pears in cartons. Their standard of packing and grading frequently did not meet the needs of N.S.W. Regulations. The fruit had to be marked down, and the growers were warned.

Oranges.—Valencias from Queensland and New South Wales coastal district were in heavy supply throughout the season, followed by heavy supplies from M.I.A. and Murray districts. These continued to April, 1966, and overlapped with the new season's Navel crop. Valencia quality was fair to average, with few instances of dryness. Early navels from Queensland were excellent quality. The N.S.W. coastal early navels were only fair quality, and many consignments showed gas burn.

Mandarins.—Fruit from coastal districts was small and heavily blemished. Queensland Ellendales were excellent and in great demand, but a tendency to hold this variety too long led to quality-deterioration. Late Ellendale consignments from Lower Murray Areas were excellent. Good quality Imperial and Unshiu mandarins came from Hawkesbury districts, and choice quality Sovereigns from Queensland.

Lemons.—There were light to medium supplies of coastal lemons, of average quality. Quality Meyers again arrived in excellent condition, and rated Special grade. A few lemon consignments came from Western Australia and, due to time in transit, showed a lot of waste through breakdown.

Grapefruit.—Local coastal fruit was of only moderate quality, mostly Plain grade. It was followed by better fruit from the M.I.A. and Mid-Murray districts and South Australia. Demand was light and breakdown and mould wastage occurred.

Peaches.—Local Spinks and Watts varieties were available in November, but were small fruit—due to drought. Late fruit from the M.I.A. showed a lot of breakdown due mainly to Brown Rot.

Nectarines.—Nectarines were in very light supply and fair average quality.

Apricots.—Glengarry and Caselin were received in October and November; there was breakdown by Brown Rot in the humid conditions at this time. Supplies of later fruit from the M.I.A. also showed breakdown.

Plums.—Plums were in insufficient supply for the early season demands. Size was generally small.

Cherries.—These were in very light supply, due to unfavourable weather.

Grapes.—Maturity testing was again carried out by the Queensland Department of Primary Industries and this prevented a large quantity of immature grapes being forwarded from that State. Testing was also carried out at the city markets. Some consignments were seized and destroyed for immaturity.

Bananas.—Testing for salicylanilide dipping was carried out. Some consignments showed no evidence of salicylanilide.

Pineapples.—The supply was moderate and the fruit sound.

Strawberries.—Early strawberries were moderate quality but presentation has improved. From November onwards a regular supply of very attractive fruit packed in foil arrived from New Zealand; 17,218 cartons in all, each containing about 15 punnets.

Tomatoes.—Tomatoes were in fairly even supply throughout. Generally quality was inferior, reflecting mosaic and weather damage.

Potatoes.—Drought also influenced the potato season. Early supplies from New South Wales and Victoria had a high percentage of small tubers, and some Internal Fleck, but quality later in the season was better. Of the 1,560,000 bags of potatoes forwarded to the Sydney market, 59,580 were from New Zealand. Some 75,458 bags were rejected because of non-compliance with Potato Grading Regulations.

Gegetables.—The supply was consistent throughout. Considering the season the quality was excellent. There was notable improvement in the marketing of some root vegetables, by use of polythene bags.

Adverse Certificates and Prosecutions.—Totals of 1,839 Downgrading Certificates and 1,489 Castaway Certificates were issued; and there were 10 prosecutions for the year.

Plants, Fruit, and Vegetables to other States.—During the year, 3,780 plants were inspected before dispatch to other States. Of these, 1,920 were treated with diazinon. Some 3,789 cases of fruit and 12,684 cases of vegetables also were inspected.

IMPORT INSPECTIONS

Pasture Seed.—A total of 29,482 sacks of pasture seed were imported; some 20,000 sacks less than in the previous year—a result of prevailing drought conditions.

Vegetable Seed.—Imports totalled 2,821,000 lb, mainly from U.S.A., United Kingdom, and New Zealand; an increase of one million lb over the previous year's total.

Flower Seed.—Imports totalled 60,526 lb; some 2,000 lb more than in the previous year. Most of the seed was from U.S.A., Holland, and Japan.

Nursery Stock.—Imports of all forms of nursery stock were about 50 per cent higher than for the corresponding period last year. These included 4,985 orchids, 2,626 ornamentals, 1,002 succulents and cacti, 208 aquatic plants, 5,000 bulbs and rhizomes, 2,012 rose budding eyes, and 163 sugar cane cuttings. Incidence of pest and disease was less frequent than in previous years possibly due to increasing overseas awareness of the Quarantine Regulations here. All plants were dipped or fumigated on arrival, and 42 plants were destroyed because of disease.

Parcels Post.—Examination of all goods and articles arriving from overseas through the parcels post, which are subject to or may be subject to Quarantine Regulations, continued throughout the year. Some 7,996 parcels and packages were withheld for examination. Of these, 1,599 were detained for further examination, treatment, or destruction.

Passenger Ships.—226 overseas passenger vessels were met on arrival for examination of goods and articles brought to attention by Customs. Considerable quantities of prohibited and infested goods were detained. These included fruit, plants, seeds, wood cases, woodware, bamboo, etc.

Aircraft.—Aircraft arriving at Mascot from overseas totalled 5,157; an increase of 695 flights over 1964–65. These discharged 323,581 passengers, an increase of 46,927. About 2½ tons of fruit were intercepted, from the passengers.

There were 1,445 inspections of quarantine cargo. Of these, 1,208 items were held for further treatment. Inspections were carried out on 17,128 cartons of strawberries from New Zealand. Also, on 529 cartons of flowers, 229 cartons of orchids, and 366 cases of cherries being exported by air.

Cases and Packing at Wharves.—At overseas wharves there were daily inspections of cases and outside-packing of general merchandise that does not usually come under quarantine. This was for detection of sirex and other wood boring insects. Infestation was found in cases, casks, bales, and bamboo slats, etc. Some 4,350 items were treated or destroyed under supervision.

Dunnage.—Considerable dunnage was placed on the wharves from overseas ships. A large percentage was infested with wood boring insects. About 289,000 super feet of dunnage was fumigated under supervision, and 270,000 super feet destroyed by burning.

Personal Effects.—There were 1,355 appointments made to inspect personal effects; 47,545 pieces were inspected. Of these, 2,103 pieces were treated because of infestation, and released.

Quarantine—Waterfront.—Regular inspections of ships' cargoes were carried out. A major item was inspection of all imported motor vehicles for presence of soil. Of the 13,549 vehicles inspected, 2,536 were not new, and 33.7 per cent of these required steam cleaning.

Importation of beans (*Phaseolus*) for processing (restricted import) dropped by 11 per cent to 26,000 bags.

Of cases containing cashew nuts, nearly all of the 39,000 cases from India were found borer infested—some heavily. Fumigation or destruction followed.

Large quantities of raw spices were contaminated with foreign seed. Cleaning and processing under supervision were necessary.

Despite advice to exporting countries, large and frequent quantities of cereal straw, mostly rice, in various forms for packing purposes, were intercepted. Destruction by burning followed.

Potatoes.—Due to shortage of potatoes, permission was granted to import potatoes from New Zealand—for processing and the open market. Some 99,438 bags were received and processed or treated under quarantine supervision.

Timber.—The total of timber imported into the Ports of Sydney and Port Kembla was 228,796,000 super feet, an increase of 8,100,000 super feet over the previous year's total. About 2,099,000 super feet were quarantined and treated because of wood boring insects. It is interesting to note an increase of 10 per cent in sawn timber and a decrease of 45 per cent in logs imported; an increase of 30 per cent in infested sawn timber and a decrease of 33 per cent in infested logs.

EXPORT INSPECTIONS

Fresh fruits, seeds, rice, wheat, and flour, submitted for export were examined on behalf of the Commonwealth Department of Primary Industry under the provisions of the Commerce (Trade Descriptions) Act.

Apples.—A total of 154,513 bushel cases and cartons of apples were shipped from the Port of Sydney; about 28,000 bushels less than in the previous year. Most were consigned to the United Kingdom and Continent. Smaller quantities were shipped to Asian Ports and Pacific Islands.

Quality of fruit shipped was very satisfactory in view of the adverse climatic conditions during the growing season. Rejects totalled 5,227 cases and cartons. The reasons were stem punctures, breakdown, overmaturity, pit, sunburn, bruising, San Jose Scale, underweight cartons and excessive pre-cooling temperatures.

Most of the fruit was supplied from M.I.A., Northern Tablelands, Orange and Batlow Districts. Of the total, 188,818 bushels of apples were in cartons.

Pears.—The quantity shipped was 22,933 cases, slightly less than the previous year's total. Most were consigned to Pacific Islands and Malaysia. There were small shipments to the United Kingdom. The pears were mainly Good grade. Rejects totalled 941 cases. The reasons were ripe pears, and San Jose Scale.

Citrus Fruits.—Only 47,144 bushel cases of oranges were shipped; about 29,000 bushels less than the previous year. The main supply came from the M.I.A. Most were supplied to the Pacific Islands and Malaysia. The rejects totalled 948 bushel cases, all rejected for frost injury; the cause of the decrease in quantity shipped.

Only 670 cases of lemons were shipped to Pacific Islands less than half of last year's quantity. Only 29 cases were rejected, for grader damage.

Grapefruit shipped totalled 740 cases; slightly less than the previous year's quantity.

Mandarins shipped totalled 5,022 cases; 2,500 more than in the previous year. Most were consigned to Vancouver; the rest to Pacific Islands.

The 12,797 cases of grapes shipped provided an increase of 3,000 cases. Most were from the M.I.A. and shipped to Pacific Islands.

Stone Fruits.—Some 3,108 cases of cherries were exported, about 300 less than in the previous year. The cherries were smaller and of poorer quality. Main destinations were Pacific Islands and New Guinea.

Miscellaneous stone fruits exported totalled 6,703 cases, a slight increase on last year's quantity, and they were mainly to Pacific Islands and New Zealand.

Miscellaneous Fruits.—These were mainly mangoes, avocados, custard apples and rockmelons. They totalled 805 cases and were mainly to the Pacific Islands.

Tomatoes.—The 8,243 cases shipped comprised a total comparable to the previous year's. Most were consigned to Pacific Islands and New Guinea.

Vegetables.—The 38,420 packages of vegetables shipped were mainly to the Pacific Islands.

Rice.—A total of 79,815 tons of rice were exported, 5,000 more than in 1964–65. The quantity is steadily increasing each year. It is mainly to New Guinea, New Zealand, Pacific Islands, and Fiji. This year 4,500 tons were exported to Japan.

Seed.—Large quantities of seeds were exported, mainly to U.S.A., New Zealand, Japan, Hong Kong and Pacific Islands. The total includes 5,001 bags of pasture seeds, 61 bags of tree seed, 43,252 bags of various cereal seeds, 394 consignments of flower seed, and 1,872 consignments of vegetable seeds in packets.

Plants.—A total of 340 consignments were exported, mainly to New Zealand.

Wheat.—Ninety-nine vessels were surveyed under the Grain Export Regulations; 19 of these were rejected because of infestation, and had to be cleaned, sprayed or fumigated before being permitted to load wheat.

Of 1,024,419 tons of wheat exported, 49,288 tons were rejected because of infestation.

Because of the severe drought, export of wheat from New South Wales was discontinued in November. The amount shipped was 1,131,416 tons less than for the corresponding previous period.

Flour.—A total of 68,335 tons of flour were exported; just half the previous year's total—due to drought.

NURSERY INSPECTIONS

Health Certificates Issued.—118 inspectional visits to nurseries, resulted in 288 "freedom from disease" certificates, involving 28,181 plants; and 221 visits resulted in 456 fumigation certificates, involving 93,547 plants.

Disease incidence was low.

Only slight incidence of citrus Gall Wasp infection was experienced and this was in trees in tins, carried over from the previous year.

COMMONWEALTH QUARANTINE ACT (PLANTS) INSPECTIONS FOR COMMONWEALTH DEPARTMENT OF HEALTH

Registered Quarantine Houses.—Some 247 visits were made to registered quarantine houses, to inspect plant growing under post-entry quarantine. The number of plants imported was 16,016, in 312 consignments.

Twelve premises were inspected for registration of glasshouse facilities to grow plants under post-entry quarantine.

Seed Firms.—104 visits to seed firms were made, to inspect dry-conditioned seed, sample seed for submission to the Seed Testing Laboratory, or re-inspection of seed for insect infestation.

EXPORT REGULATIONS (GENERAL) INSPECTIONS FOR COMMONWEALTH DEPARTMENT OF PRIMARY INDUSTRY

International Phytosanitary Certificates.—Inspectional visits of this type totalled 271. They resulted in 200 International Phytosanitary Certificates involving 9,202 plants; and 853 International Phytosanitary Certificates involving seed. Seven visits were made to seed firms to supervise fumigation of large quantities of seed for export.

DIVISION OF ANIMAL INDUSTRY

General

STAFF

Veterinary Staff.—Eleven veterinary officers were appointed. There were two resignations. A new District veterinary officer position was created, at Bourke, and was filled by appointing a veterinary inspector to it. There is one vacancy for a veterinary officer in the Divisional establishment.

One veterinary inspector was appointed; one resigned to accept the position of District veterinary officer at Bourke; a veterinary inspector ceased duty but his resignation was not accepted. There are 25 vacancies for veterinary inspectors.

Two veterinary trainees resigned before completion of their University course.

Livestock Research Staff.—Two new positions were created. There was one resignation. Three livestock research officers were appointed bringing the total to 24. This comprises the full establishment.

Cattle Tick Research Staff.—Two research officers were appointed, increasing the Station's research staff to six. One vacancy for a research officer exists.

Sheep and Wool Section Staff.—This Section was increased by creating two new positions. There were three new appointments. However, one officer was transferred to be Manager of an Agricultural Research Station. One position in the Fleece Measurement Service, financed by the Australian Wool Board, was relinquished. One livestock officer was seconded to occupy a position of Regional Supervisor. One vacancy exists.

Beef Cattle Section Staff.—One officer was transferred to Wagga Agricultural College as lecturer. This resultant vacancy has not been filled.

Piggery Section Staff.—Three appointments were made. There was one resignation. One officer died through an accident. The establishment provides for 16 positions. There is one vacancy.

Poultry Section Staff.—Five officers were appointed but, of these, two resigned. There was one death. Two officers were transferred to other sections of the Division. The Section is now three below the established strength.

Apiculture Section Staff.—There was one resignation and one appointment.

Advanced University Degrees.—Dr W. A. Pattie, Livestock Research Officer was awarded the Ph.D. by the University of N.S.W. for his thesis on "Selection for Weaning Weight in Merino Sheep". Dr J. M. Holder, Special Veterinary Research Officer, was awarded the Ph.D. by the University of New England for his thesis on "Studies of Factors Affecting Feed Intake of Cattle". Mr P. A. McInnes was awarded the M.Sc. degree by the University of N.S.W. for his thesis "The Effect of Different Protein Levels on Maintenance Requirements of Sheep".

At present three officers are overseas for academic studies, two for the Ph.D. and one for an M.Sc. Six others are on leave to pursue Ph.D. degrees in Australian Universities, and one other officer is pursuing the M.Sc. degree.

One veterinary research officer returned to service with the Department, after completing Ph.D. studies.

Chemist Overseas.—Under a grant from the Australian Meat Board, Mr J. Dingle, Chemist in Charge of the Board of Tick Control Laboratory spent three months in the U.S.A., Canada and England. He investigated various aspects of analytical work with particular reference to insecticide residues in animals and carcasses.

Livestock Health—Regulatory Disease Control

STOCK DISEASES ACT AMENDMENTS

During the year, the Stock Diseases Act was amended by Parliament, to provide powers not previously possessed, to be called on in the event of an outbreak of an exotic disease. Some changes were also made to improve control of diseases already existing in Australia. The principal amendment in the latter category requires practising veterinarians to report scheduled diseases they encounter.

ANTHRAX

Nineteen outbreaks occurred; considerably fewer than normal in recent years. Drought probably explains the reduction. Most outbreaks caused few deaths, but on one property 65 sheep were lost through the disease.

An outbreak in the Tamworth district was the first there for at least 60 years, so far as is known. The area is outside the recognized anthrax-belt. The outbreak resulted in death of 22 cattle, of 704 head on seven properties affected.

Consistent with longstanding policy, stock routes and reserves on which stock had died from anthrax during the preceding five years were quarantined for the summer months. Use was limited to stock vaccinated against anthrax or being conveyed by motor vehicles. Nineteen such routes and reserves were quarantined.

Stock in the enzootic area were preventatively inoculated by persons licensed by the Department of Agriculture; 78,345, on 92 properties, were so vaccinated.

The following table shows the distribution of outbreaks:

DISTRIBUTION OF ANTHRAX OUTBREAKS 1965–66

Administrative District	Outbreaks	Stock Quarantined				Deaths			
		Cattle	Sheep	Pigs	Horses	Cattle	Sheep	Pigs	Horses
North	7	704	488	33	18	22	..	..	..
South	1	104	2,671	..	..	10	3	..	..
South West	9	344	2,248	110	..	28	65	8	..
West	2	117	823	30	..	1	..	1	..
Total	19	1,269	6,230	173	18	61	68	9	..

BRUCELLOSIS (PIGS)

No outbreak was recorded. The voluntary Brucellosis-Free Herd Scheme was maintained. Fifteen herds were accredited. In each of two accredited herds, one positive reactor was detected during testing. Because of the known high incidence of non-specific reactions to the agglutination test, both reactors were retested. In one the retest proved negative. In the other the retest, done at the close of the year under report, proved positive. Action is being taken to slaughter that pig and to further test the herd.

In all, 240 tests were done during the year, without further positives.

FOOTROT (SHEEP)

No serious problem with footrot occurred. The incidence was below average, undoubtedly due to the drought conditions.

The boundaries of the Armidale Footrot Quarantine Area have been extended, doubling the size of the area.

In this area, two more infected properties were detected. At the start of the year eighteen properties were affected and undergoing eradication. During the year infection was eliminated from ten properties, leaving ten still infected. Of those properties from which the disease was eradicated: elimination of infection from five was achieved by treatment of infected and in-contact sheep; from three others by treatment, and consignment for slaughter of all affected sheep; and from the other two by forwarding for slaughter all infected and in-contact sheep.

Advantage was taken of the dry weather in the Armidale area to concentrate on certain very large sheep stations where infection has been in many sections and where there has been difficulty in eradicating the disease.

Under the Stock Diseases Act, the definition of footrot has been broadened to include infection with organisms resembling *Fusiformis nodosus.*

JOHNE'S DISEASE

Three outbreaks were recorded. In each case only one animal was found affected. One of the properties concerned is a large estate comprising a number of dairy farms. The history of the disease there started some twenty years ago with the finding of infection in an imported Jersey bull. A second property where the disease was found this year had received stock from a property found infected in 1964–65. In the third case, there was no link with any previously known source of infection.

Five properties where Johne's disease had been previously diagnosed were maintained in quarantine. From one of these, cull-cattle consigned to an abattoir for slaughter were subjected to careful examination for possible presence of the disease. Forty-four carcasses were so examined, and blood samples were taken at slaughter—for the complement-fixation test. All reactions were negative, with the exception that one sample gave a weak positive reaction. No lesion of Johne's disease was seen. Culture-examination returned negative results in all cases.

During the year, 159 johnin tests were applied to cattle to meet sale and export requirements and for diagnostic purposes. All reactions were negative.

PARASITES EXTERNAL (SHEEP)

The following table shows the number of holdings and sheep quarantined for lice (*Damalina ovis*) and ked (*Melophagus ovinus*) in different areas of the State:

Administration Area	Lice Infestation		Ked Infestation		Lice and Ked	
	Holdings	Sheep	Holdings	Sheep	Holdings	Sheep
Central	24	33,569	..	..	..	..
Central West	110	77,781	18	7,354	6	5,115
Cumberland	6	3,577	..	..	..	..
Far West	20	73,040	..	..	..	..
North	145	182,357	54	56,160	11	8,804
North West	60	107,084	1	1,000	..	..
South	88	87,597	3	564	..	..
South East	70	62,227	86	122,301	11	8,652
South West	146	104,089	..	..	..	..
West	19	16,700	..	..	..	..
Totals	698	748,021	162	187,379	28	22,571

PLEUROPNEUMONIA CONTAGIOSA (CATTLE)

No outbreak occurred. One clinical case of respiratory infection was destroyed as a possible suspect. Necropsy showed that PPC was not involved. Some 2,235 complement-fixation tests were done to meet requirements for export and entry into two protected areas in N.S.W. Two samples returned positive reactions but on retest the stock proved negative.

Surveillance was maintained over Queensland cattle. Following the diagnosis of this disease in Victoria, additional restrictions were temporarily placed on the entry of Victorian cattle into the protected areas.

PULLORUM DISEASE (POULTRY)

Twenty-eight outbreaks were diagnosed. Affected birds ranged in age from a few days to seven weeks, with a mean of two to four weeks. Mortality varied from .01 per cent to 60 per cent, with a mean of 13.5 per cent. *Salmonella pullorum* was recovered from all examined chickens which showed lesions and from two not showing lesions.

Flock-testings were done under the Stock Diseases Act regulations requiring annual testing of flocks from which chickens under three weeks of age or hatching-eggs are sold, and under the voluntary Accredited Flock Scheme. The next table shows details for the two flock categories of testing:

PULLORUM TESTING

Scheme	Flocks	Birds	Reactors	Reactor Percentage
Accredited Flocks	113	595,366	2,112	0.35
Compulsory Testing	101	94,225	519	0.55
Totals	214	689,591	2,631	0.37

The total of birds tested was significantly less than the 798,686 tested in 1964–65. Most of the reduction was in flocks compulsory-tested; 171,493 in 1964–65 and 94,225 in 1965–66. This was because many flocks, especially smaller ones, have gone out of production. The overall incidence of disease declined from 0.5 to 0.37 per cent.

The Stock Diseases Act regulations for pullorum-testing have been amended. These now require re-testing after thirty to thirty-five days in flocks where reactor-incidence is 0.5 per cent or more, instead of above 2.0 per cent. The new regulations also require retesting when only a group of birds is tested and reactor-incidence is above 0.5 per cent.

Some problems occurred in testing. In one large flock of 70,000 birds where only a percentage of infection had been previously detected, a test of 5,933 revealed 733 reactors. The rapid whole-blood test had been used. These reactors were destroyed. In the following week, a check-test of a random-selected group revealed 10 per cent reactors.

Some of these birds were forwarded to a commercial laboratory and, with the tube-agglutination test, a correlation of 60 per cent was obtained. The commercial laboratory was not able to isolate *Salmonella pullorum* from any of the birds.

The Department then compared two commercial antigens in testing birds from this property. One antigen resulted in eight times as many reactors as the other antigen.

At the Colin Blumer District Veterinary Laboratory, Armidale, the significance of fine reactions to the rapid whole-blood test was examined. There was no difficulty in isolating *Salmonella pullorum* from birds showing obvious agglutination but, invariably, birds showing fine reactions—in the same flocks—failed to yield the organism.

SWINE FEVER

No outbreak was recorded. But as a precaution all pigs were destroyed in a herd where unexplained heavy mortality in young pigs was occurring. Histopathological examination of brain tissue disclosed lesions suggesting swine fever, although transmission and gel diffusion precipitin-tests had been negative. A transmission test was also done with material from another property where history, symptoms, and post-mortem findings suggested swine fever. The results were negative.

Pig sera collected at random at abattoirs were tested against swine fever antigen. There were 37 positive reactions in 772 samples. Their significance is not understood but they do not appear to indicate infection. Sixty cattle-sera were also tested against swine fever antigen, resulting in six positive reactions. Piggery inspections were continued.

Regulations previously introduced to control swine fever remained in force. They included the compulsory boiling of all garbage prior to feeding to pigs, and a total ban on the sale of pigs in public saleyards—except for immediate slaughter. Boiling facilities at piggeries where offal was fed were subject to inspection, with particular attention to farms where refuse was obtained from military camps. The contract held by one person for garbage from such a camp was cancelled because of his repeated failure to boil garbage satisfactorily before feeding.

There is strong evidence that the regulations designed to prevent the spread of swine fever have been instrumental in significantly reducing the incidence of two of the most economically serious enzootic diseases of pigs, contagious pneumonia and salmonellosis. For instance, this year an owner in the Deniliquin district sustained a heavy mortality from salmonellosis in a line of 31 store pigs purchased privately. These pigs were almost certainly in the incubative stages of the disease at the time of sale.

If the sale of stores were allowed, those pigs almost certainly would have been offered in a public saleyard and may have been purchased by a number of owners. The pigs could also have spread infection to others in the saleyard.

There is now a much lower incidence of severe diseases than when store pigs could be sold in public saleyards. This is shown by figures for carcass condemnations for septic conditions. Prior to prohibition of this practice in 1962, some 0.5 per cent of pig carcasses were annually condemned for septic conditions. For 1965–66, the figure was 0.097 per cent. Particulars of pig carcass condemnations for septic conditions by the State Meat Inspection Service for the period 1959–66 are in the next table:

Year	Pigs Slaughtered	Carcasses Condemned	Per cent Condemned
1959-60	414,944	2,416	0·587
1960-61	478,952	2,524	0·527
1961-62	525,506	1,399	0·266
1962-63	457,872	1,014	0·222
1963-64	424,846	946	0·222
1964-65	471,531	704	0·149
1965-66	568,895	550	0·097

On the far north coast, where swine fever did not occur and where the ban on the sale of store pigs was not introduced until 1964, a similar reduction in carcass condemnations has occurred. The next table shows the extent of condemnations for septic conditions at Byron Bay and Casino abattoirs for the period 1962–66:

Year	Pigs Slaughtered	Carcasses Condemned	Per cent Condemned
1962-63	139,907	682	0·49
1963-64	126,296	665	0·53
1964-65	162,148	428	0·26
1965-66	190,707	347	0·18

TRICHOMONIASIS (CATTLE)

There was no diagnosed outbreak. This was the first such year for a considerable period. One property was released from quarantine restrictions imposed in 1964–65. Quarantine was maintained on one other property where the disease was diagnosed in the preceding year.

TUBERCULOSIS (CATTLE)

Area Eradication.—The programme of tuberculosis eradication on an Area basis, initiated in 1960, was continued. But expansion of the scheme was frustrated by drought conditions. In consequence the total of 674,522 tests applied was not so great an increase over the 629,228 of the previous year as had been desired. There were, however, significant reductions in the number and percentage of detected reactors. These totalled 1,277, as against 2,374 for the previous year; a reduction from 0.38 to 0.19 per cent. Details of testing during the year are summarized in the next table:

	Cattle Tested	Reactors	Per cent Reactors	NVL* Reactors	Per cent Reactors NVL
1st Round	174,906	344	0·20	84	24·5
2nd Round	193,804	219	0·11	79	36·1
3rd Round	112,086	197	0·18	72	36·5
4th Round	111,410	138	0·12	40	29·0
Retests	42,755	356	0·83	87	24·4
Introductions	39,561	23	0·06	11	47·8
Totals	674,522	1,277	0·19	373	30·0

* "No Visible Lesion"

An additional Area was gazetted, increasing the total to seventy. Testing was done in 67 areas. A high level of infection was found in several herds which were considered free of infection at the previous annual or biennial test.

One herd of 157 cattle revealed 20 reactors, and 16 were advanced cases. As far as is known, over the five years since testing was started in this herd, all introduced cattle had been tested at time of introduction. It is suspected that an infected cow had persistently given a negative reaction.

In another herd which had been previously tested, 41 of 91 head of cattle reacted.

In some herds, "no visible lesion" reactors presented a problem. On one property non-specific reactions have been occurring for two years. In this period, 17 reactors have been slaughtered and have not shown evidence of tuberculosis on postmortem examination. Many other animals have also reacted in this period but have been negative on subsequent retesting. This year, so-called "skin tuberculosis" symptoms were found in the herd.

Tubercle-Free Herd Scheme.—Under this voluntary Accreditation Scheme, 73 herds and 12,230 head of cattle were tested. There were two reactors.

Tubercle-Free Milk Scheme.—Two schemes exist. One is administered by the N.S.W. Milk Board in the case of the larger cities and the other by Municipal and Shire Councils for smaller cities and towns. The schemes are designed to ensure that raw milk sold for human consumption is produced by herds accredited as tubercle-free by the Department of Agriculture. Under these schemes, 7,776 head of cattle were tested, with detection of five reactors.

Miscellaneous Testing.—Testing under this heading included compulsory testing of infected herds; and voluntary testing for export, sale, exhibition or diagnostic purposes. Tested cattle totalled 39,592, for 763 reactors. Testing on a number of large beef cattle stations, started in the previous year, was continued.

TUBERCULOSIS (PIGS)

Some 1,304 tuberculin tests were applied to pigs. There were 373 reactors. Much of the testing was associated with a large commercial piggery of some 3,000 pigs. Pigs from this property have shown on slaughter a high incidence of abscesses in the lymph glands of the head and abdominal cavity. Laboratory examination of affected glands showed the abscesses to be tubercular.

A comparative test on 118 dry sows proved eight positive, and 20 suspicious to avian tuberculin and two suspicious to mammalian tuberculin. Subsequent testing on this property yielded 27 positive and 70 doubtful reactions, out of 233 brood sows. Subsequently 558 baconers were tested. Of these, 205 were positive and 229 doubtful. Test and slaughter correlation was poor. Tuberculosis lesions were found in 76 per cent of positive reactors, 66 per cent of doubtful reactors and 52 per cent of negative reactors. The source of the infection was not determined.

TUBERCULOSIS (POULTRY)

Fifty-six properties were placed in quarantine for this disease, and 38 previously quarantined were released. During the year, 1,195 tuberculin tests were done and 115 reactors were detected.

Among the released properties was a large holding involving some 12,000 ducks. The disease had been eliminated by the disposal of the original birds for slaughter, and cleansing and disinfection of the pens.

In the Corowa district where avian tuberculosis is enzootic, random testing of 696 birds on 20 holdings detected 100 reactors. Seventy of these reactors showed lesions on slaughter.

Following diagnosis of avian tuberculosis in Queensland, near the border, birds on adjoining properties in New South Wales were tested. Birds tested totalled 414, in 13 household flocks. All were negative.

General Disease Problems

ACORN CALVES

Occurrence of acorn calves was widespread in beef herds this year. Herefords, Shorthorns, Angus and their crosses were involved. On one property, 40 affected calves were born to 100 breeding cows in poor condition. Affected calves were small, usually under 22 in in height at the withers, and had undershot lower jaws, very short limb bones and enlarged joints.

The unusually high incidence may have been associated with the drought and poor feed conditions.

BRUCELLOSIS (CATTLE)

Tests for this disease totalled 2,856. Of these, 298 were positive and 235 doubtful. The Accredited Brucellosis-Free Herd Scheme was maintained. Seven herds were accredited. Under this scheme, 1,081 individual tests were done. Seven were positive and seven doubtful.

Infection was found in one accredited herd. The source was not confirmed, but it was ascertained that workmen had been allowed to run cattle near to where the accredited herd was maintained.

On two properties, brucellosis was confirmed as a cause of high abortion rates despite affected animals having been vaccinated with strain 19 when calves. The cause of breakdowns was not determined.

BRUCELLOSIS (SHEEP)

Tests for diagnosis, sale and export purposes totalled 2,328. There were 221 positive reactors and 55 doubtful. The serum complement-fixation test was used. The disease has occurred mainly in sheep of British breeds.

Near the end of the twelve months under report, a voluntary Brucellosis-Free Flock Scheme designed to ensure the sale of uninfected rams was established. So far, one flock has been accepted but testing of the sheep has not yet been undertaken.

CEREBRAL HYPOPLASIA (CALVES)

This was diagnosed as affecting eight calves, born in a herd of 65 cows. A familial and inherited simple-recessive factor is suspected as the cause. Affected calves at birth showed spastic paralysis, apparent blindness and opisthotonis.

COPPER DEFICIENCY (CATTLE)

A case of copper deficiency, with sudden deaths, was found in a north coast beef herd. The herd had been maintained on recently drained swamps. Deaths totalled 15, of 300 head. Some deaths had followed symptoms of emaciation, diarrhoea and loss of coat colour. Other deaths were sudden. One cow went down after walking 30 yards from release from a crush after a tuberculin test, and died three minutes later. Its liver-copper level was 4 p.p.m. Liver tissue showed large brown pigment-granules within Kuppfer cells and in portal macrophages. Fine brown pigment-granules were present within periportal hepatocytes. There was no pigment accumulation in bile ductules.

CONGENITAL DEFORMITY (CALVES)

An apparent abnormality affected calves in a small Galloway stud herd established in 1951 with imported stock. A genetic factor is suspected. Other breeds of cattle have been maintained on the property, but all affected calves have been sired by Galloway bulls and out of Galloway or Galloway-Hereford crossbred cows. At least three bulls sired the affected calves.

The condition comprised calves being presented with hind legs flexed at the hocks, a tendency in some to twist the neck, and in most cases a large umbilical hernia with no hair on the overlying skin. In about half the affected calves, the brain has been exposed and sometimes protruded. Hind limb joints have been ankylosed.

Characteristic necropsy findings have been the absence of muscles from the central abdominal wall posterior to umbilicus and the absence of the patella, the distal row of tarsel bones and the articular surface of the femur. The pelvic girdle had only a fibrous floor with the pubic bones absent. The cranial bones had failed to meet in the occipital region.

CLOVER DISEASE (SHEEP)

Oestrogenic toxicity occurred in one flock grazing subterranean clover. The flock experienced low fertility, together with foetal deaths and dystokia—the latter giving rise to infection of the genital tracts.

COCCIDIOSIS (LAMBS)

Many coccidiosis outbreaks occurred in lambs during the winter and early spring, associated in particular with confinement of the animals in small areas for drought feeding. The condition mostly responded to sulphonamide therapy and a change of environment. Some heavy mortalities were encountered. In one case, 300 of 900 lambs were lost; in another, 100 of 450 were lost.

CYSTICERCUS BOVIS

Specimens from suspected *Cysticercus bovis* cases were forwarded by meat inspectors to the Veterinary Research Station, Glenfield. Fifteen samples were examined. Four were classified as positive, following recovery of the distinctive scolex of *C. bovis* on dissection. A fifth was classified as positive, after showing scolex material in the degenerating centre of the lesion.

Attempts to trace the origins of infection were not successful. But in most cases the cattle had access to areas traversed by fishermen, shooters, and itinerant workers.

DROUGHT-FEEDING PROBLEMS

Many losses in sheep and cattle being drought-fed on grain or manufactured pellets came under notice. Often these were due to failure to observe the recommended precaution of introducing the grain gradually. In some of the cases the official recommendations had been closely followed.

There were cases of sickness in pregnant ewes being fed grain-rations in excess of five feed units per week. The ewes showed diarrhoea and refused to eat the full ration. The trouble was mainly associated with wheat-feeding but also occurred in ewes being fed oats. Replacement of part of the grain ration with roughage overcame the problem.

ENTERITIS (CALVES)

There was a high incidence of diarrhoea affecting the newly-born beef calves, with symptoms similar to those of the colibacillosis, in several herds on the central tablelands where this has been a problem in past years. In one herd almost all of 50 calves were affected, and although none died the animals' growth was retarded. In another herd there was a 30 per cent mortality.

Organisms resembling *Clostridium perfringens* have been recovered from affected animals, but their significance has not been clarified. Antibiotics and other forms of therapy have given variable and generally unsatisfactory results.

ENTERITIS (SHEEP)

Several different types of enteritis occurred in sheep. Cases of diarrhoea were seen in young sheep being fed solely on wheat. The condition did not appear to be wholly dietetic in origin. Oral treatment with sulphonamide frequently cured the condition. The symptoms also appeared to respond to increased roughage in the diet.

A scouring syndrome occurred on a highly-improved property where very heavy stocking rates were practised. The condition occurred mainly in late lambs of very low body-weight. The feed consisted of good bulk of predominantly *Phalaris* and ryegrass pastures, which to visual appraisal would be regarded as adequate although not highly attractive to young sheep. Investigations failed to determine the cause. Response to oral streptomycin treatment was good.

On several properties, the syndrome involved lesions affecting the large intestines.

In one case, persistent diarrhoea occurred in Merinos feeding on rye grass and clover pastures. Animals affected were weaner lambs and some mature lambs and rams. Of 2,000 head, about 500 showed symptoms and there were two deaths.

Lesions were severe inflammation of the mucosa of the caecum and colon, the walls of which were considerably thickened. Rectal walls were thickened with scale-like lesions on the mucosa. After several forms of therapy had been unsuccessfully tried, the condition appeared to respond to a combination of streptomycin and sulphamide.

In another case, a similar condition occurred in a group of 240 crossbred weaners. Of these, ten died and 13 showed symptoms. There was no macroscopic evidence of coccidiosis, but pathological examination revealed mild subacute coccidiosis. The cause of this syndrome has not been determined.

In another case, gross typhlitis with catarrhal enteritis was found associated with deaths in lambs after short-duration scouring.

INFECTIOUS LARYNGOTRACHEITIS (POULTRY)

This disease was commonly encountered, with unexpectedly high incidence among birds under three months of age. In general, the operating virus seemed less virulent than is usual. There was less morbidity and mortality in affected flocks.

The disease was diagnosed in the Tamworth Infectious Laryngotracheitis Protected Area. To prevent introduction of the disease, the entry of only day-old chickens had been permitted. Following the diagnosis, a survey was made. This involved submission of samples from random birds in many flocks to the serum-neutralization test.

The survey revealed the disease to be widespread, but mostly as a sub-clinical entity. But in some flocks the disease was causing light mortality and some decline in egg production. Because of the low-grade infection, the use of a live vaccine in the area was considered undesirable. But experimental work to test the effectiveness of a killed vaccine is proceeding.

MUSCLE NECROSIS IN MERINO LAMBS

An outbreak affected Merino lambs in the Balranald district. From a mob of 820 ewes and 323 lambs, 35 lambs died after showing gait and stance typical of muscular dystrophy. A further 65 were affected but recovered. Symptoms and mortality were precipitated when the sheep were driven a quarter of a mile for marketing.

The country was not of a type previously considered conducive to this disease. It was typical red western soil, with feed freshened by rain two to three weeks prior to the outbreak. Necropsy revealed symmetrically distributed grey lesions in the limb muscles. Histopathological examination revealed calcification of necrotic fibres.

Because the lambs had access to the native pig weed *Disphyma australe,* a feeding trial was undertaken at the Veterinary Research Station, Glenfield. Heavy feeding of four lambs with the plant, accompanied by forced exercises, failed to reproduce the condition.

MYCOPLASMOSIS (POULTRY)

This condition was seen frequently in all parts of the State. In turkeys, there were lesions of air saculitis without sinus involvements. The sera from these birds failed to agglutinate with the common *Mycoplasma* strain antigen. The condition could be due to the N strain of *Mycoplasma* recognized in America. So far this has not been confirmed.

NECROTIC ENTERITIS (POULTRY)

Outbreaks were common and losses were greater than in the previous year. The disease is increasingly important in broilers in the Tamworth district. *Clostridium perfringens,* probably type F, has been recovered from some outbreaks. Toxin produced by the organism has been found to cause the death of mice, and a liquefactive necrosis of muscles of guinea pigs. Field trials to study the effects of antibiotic supplementation have been undertaken. Preliminary results indicate that furazolidone may produce satisfactory control.

NEWCASTLE DISEASE (POULTRY)

When a mild strain of Newcastle Disease virus was confirmed in Queensland during the year, a survey was made to determine infection in New South Wales and its extent. Submission of some 8,000 serum samples from random-selected birds in numerous flocks revealed widespread distribution of the virus, particularly in the Sydney and Tamworth areas.

There is no evidence that the Newcastle Disease virus has produced significant pathological effects. The virus has been confirmed in consignments of birds submitted to the Veterinary Research Station, Glenfield, from four flocks with clinical signs or postmortem features. But in all cases other pathological conditions have been present and would appear to have caused the clinical and postmortem abnormalities. Histopathological findings were not suggestive of Newcastle Disease in any of the specimens examined.

POISONINGS

Brachychiton populneum (Kurrajong).—Poisoning in adult cattle fed on this plant in the flowering stages were reported on a property. Hereford cows four to five years of age with calves at foot were affected. The toxicity of Kurrajong during the flowering stage is thought to be rare, as most cases of toxicity have occurred from ingestion of seeds.

Eight of 70 head of cattle were affected, and five died. Symptoms were hyper-excitability, a tendency to charge, ataxia, and blanching of the mucous membranes of the mouth and tongue, with excess salivation.

Festuca arundinacea (Tall Fescue).—An outbreak of "Fescue Foot" occurred on the northern tablelands in 28 head of cattle grazing a stand of tall fescue which comprised tall dry stems with seed heads and a green shoot from the roots. The condition affected one or both hind limbs of at least two-thirds of the group. Six animals died or had to be destroyed because of the condition.

Heliotropium europaeum (Heliotrope).—Sheep losses due to poisoning with this plant were high in areas where it is established. There were also some deaths in cattle. Heliotrope made heavy growth during the summer and was profuse in fallow and other cultivated areas. Because losses had been light over the preceding two years, a considerable proportion of sheep in the infested areas had probably sustained liver damage before commencing to graze during the current year. But in some cases heavy mortality was sustained by sheep introduced from other areas and which had therefore grazed the heliotrope for only one year.

Organic Phosphate.—Some sheep mortalities occurred after use of an organic phosphate anthelmintic (rametin) newly on the market. Experimental work had indicated an adequate safety margin with this preparation. But field observations indicated that the sheep to which the drench proved toxic were those in a weakened state and subject of poor nutrition because of the drought. On one property, 100 of 800 and on another 80 of 800 died.

Symptoms were extreme depression, nasal discharge, lachrymation, opacity of the cornea, diarrhoea and swelling of the face. Histopathological examination revealed mild recent centrilobular-necrosis in the liver, and degeneration of kidney cortical cells.

Panicum laveifolium.—This plant, not previously incriminated for toxic properties, was reported responsible for photosensitization affecting 80 of 700 lambs. The affected animals recovered satisfactorily.

Phalaris tuberosa.—Some mortalities from the acute form of poisoning with this plant occurred. Many of the losses were incurred by owners who had similar trouble in the preceding year, and who took care to ensure that the sheep were not hungry when introduced to the *Phalaris* and moreover limited the grazing period. One owner, who considered he had devised a system of rotation which would permit the *Phalaris* pasture to be satisfactorily grazed, lost 360 of 4,500 wethers.

In most cases, the pastures where trouble occurred were pure or near-pure stands of *Phalaris tuberosa.* But one mortality was where white clover about 3 inches high was in the pasture.

Senecio Cunninghamii.—Ingestion of this species on a property in the southwest led to Pyrrolizidine alkaloid poisoning in cattle and losses in horses on an adjoining property. In the horses the syndrome was reported to have the same pattern as "walkabout" or Kimberley Disease.

POLIOENCEPHALOMALACIA (SHEEP AND CATTLE)

This disease has emerged as increasingly important. Losses occurred over a wide area. The disease was diagnosed in sheep on 19 holdings and, in one case, in cattle. Most losses were light, but 20 per cent mortalities were reported in several cases. The disease appeared to involve sheep of all ages, although incidence was higher in older sheep. The increased number of cases appeared to be associated with nutrition-stress brought on by the drought.

POSTHITIS (CATTLE)

One unusually high incidence involved stud bulls—practically 100 per cent incidence of external ulcer in over 50 bulls. Response to antiseptic treatment was satisfactory.

POSTHITIS (SHEEP)

Incidence of this was much less than normal, because of lack of high-protein pastures through the drought. At a Departmental Research Station, 137 wethers were treated with satisfactory results using the antiseptic method recently devised when the infectious nature of this condition was determined.

PREGNANCY TOXAEMIA (EWES)

Heavy, widespread losses were reported, again associated with poor nutrition due to the drought. In one case 300 of 1,000 and in another 150 of 500 breeding ewes were lost through this disease.

PSEUDOMONAS INFECTION (RAMS)

Severe necrotizing infection of the skin of a group of Dorset Horn rams was investigated. Of 12 newly bought animals, all but two had extensive lesions on the legs, face, and throat. On postmortem examination, one ram had lung lesions. From specimens the Veterinary Research Station, Glenfield, recovered pure growths of *Pseudomonas aeruginosa.* This organism proved resistant to all common antibiotics, thus explaining the failure of treatment. Source of infection could not be determined.

TIBIA DEFORMITY (POULTRY)

Of unknown aetiology, a disease affecting the tibias was seen at a number of broiler-poultry farms. Either one or each tibia was rotated at an angle of 180°. It did not appear to greatly affect the birds. They ate and grew normally.

Q DISEASE (POULTRY)

Cases of this disease were reported in many flocks. Birds affected were from one to three weeks of age. The disease commonly commenced at nine to ten days. Mortalities were as high as 10 per cent. Characteristic necropsy findings have been straw-coloured fluid in the pericardial sac, petechial haemorrhages in the heart, and congested areas in the liver. From affected cases a viral agent has been isolated at the Veterinary Research Station, Glenfield, on embryonated eggs. Its possible aetiological role is being examined.

VIBRIOSIS (CATTLE)

This continued to be a major cause of infertility in cattle, particularly in dairy herds.

This year, a programme that was started four years ago to eliminate the disease from the stud Angus herd at Trangie Agricultural Research Station was brought to a successful conclusion. The programme was based on the build-up of an uninfected herd from virgin stock and the isolation and gradual elimination by culling of the infected herd. The last animals in the infected herd were consigned for slaughter this year. Application of the mucus-agglutination test to random-selected cows and heifers in the uninfected herd produced negative results in all cases.

At the Grafton Agricultural Research Station a similar programme has been in operation to eliminate infection from the study dairy herd. Only four cows now remain in the infected section. A test of 25 cattle in the clean herd proved negative for vibriosis.

WORMS (CATTLE)

Ostertagia spp. proved to be the most serious parasites affecting cattle. Infection was diagnosed widely in beef and dairy cattle, particularly in beef cattle. Cattle of all ages have been clinically affected, including many adults. In some cases, treatment of affected adult cattle with broad-spectrum anthelmintics has not been satisfactory. In one 9-year-old cow, over 90,000 *Ostertagia* spp. were found in a small part of the abomasal contents.

Other species found causing clinical helminthosis included *Osophagostomum, Haemonchus, Trichostrongylus* and *Cooperia.* In several cases, there was high-level infection with *Cooperia* spp. in 18-months-old cattle.

WORMS (SHEEP)

Despite the drought conditions, helminthosis was widely encountered in sheep and in some cases was associated with heavy mortality. On one property, death of 200 of 400 ewes was associated with heavy *Trichostrongylus* spp. infection. Frequently, poor nutrition predisposed to the worm infestation effect.

In the spring and autumn, *Nematodirus* spp. were frequently encountered. *Trichostrongylus* spp. were also seen often. Other species associated with mortality were *Osophagostomum, Haemonchus, Ostertagia* and *Dictyocaulus. Haemonchus contortus* was less prevalent than is usual.

Although *Monieza* spp. have not usually been considered serious parasites, there were this year several cases of lambs showing symptoms of worm infestation but failing to respond to anthelmintics effective against nematodes. They immediately responded to anthelmintics designed to remove tapeworms.

Miscellaneous Animal Health Activities

EXTENSION SERVICE BY VETERINARY PERSONNEL

Considerable extension work was done during individual contacts by veterinary officers and veterinary inspectors, when investigating flock and herd problems, but group and mass media extension was also undertaken.

Demonstrations were given at numerous field days, and lectures were given at 61 meetings. Also, sessions were provided at 27 one-day or two-day schools for farmers. Forty-five radio broadcasts and seven television segments were provided. Numerous articles and paragraphs were made available to press, radio and television services.

Some of the meetings addressed arose from a campaign to educate stockowners to the danger of introduction of exotic diseases, and to teach recognition of the more important infections. Cine films and slides on the subjects were shown. At one centre, where there is a big Italian rural-community, the Narrandera District veterinary officer arranged for a film commentary to be recorded on tape in Italian language. This was played during the film-screening. This District veterinary officer also arranged for an article on exotic diseases to be translated and published in an Italian language newspaper.

One animal health display was organized. This was for a major, farm-machinery field day at Tamworth.

CLINICAL ATTENTION AT GOVERNMENT FARMS

Departmental veterinary officers provided clinical attention and disease control services to livestock located at Government farms; 233 such services occurred. The work included testing for disease, diagnosis, treatment, vaccination, surgery, pregnancy-determinations, and postmortem examinations.

IN-SERVICE, VETERINARY TRAINING

A number of veterinary officers attended a short-term postgraduate course in parasitology arranged by the Post Graduate Committee on Veterinary Education of the Veterinary Association, in conjunction with the University of Sydney.

A refresher course in bovine-pregnancy diagnosis was held at the Veterinary Research Station, Glenfield. Two veterinary inspectors, one veterinary officer and a senior member of the insemination staff of the N.S.W. Milk Board attended.

A Special Veterinary Research Officer and a Laboratory Assistant resumed duty at the Veterinary Research Station, Glenfield, after studying respectively for two and one years in the Virology Department of the CSIRO, Parkville, Victoria.

IN-SERVICE, VETERINARY CONFERENCES

Two conferences on administration matters were held at Head Office, attended by senior administration personnel and District veterinary officers.

A conference was also held at the Colin Blumer District Veterinary Laboratory at Armidale; attended by senior veterinary officers, and by District veterinary officers, veterinary officers and veterinary inspectors in the area served by the new laboratory. Matters pertaining to the laboratory establishment, and submission of specimens and reports, were discussed.

VETERINARY NOTES—NEW SERVICE

The first two issues of this new service publication were produced this year. Copies were forwarded to veterinary officers, veterinary inspectors, rural veterinary-practitioners, drug-house veterinarians and some research personnel.

Veterinary Notes is designed to bring to the veterinarians investigating and controlling stock disease in N.S.W., the latest research findings relative to their work.

LABORATORY DIAGNOSTIC SERVICES

The total of specimens received at the Veterinary Research Station, Glenfield, and the Colin Blumer District Veterinary Laboratory, Armidale, for 1965–66 and 1964–65 are set out in the next table.

VETERINARY SPECIMENS—GLENFIELD AND ARMIDALE LABORATORIES

Specimens	1965-66			1964-65
	Glenfield	Armidale	Total	
Cattle	22,195	192	22,387	29,076
Sheep	10,090	271	10,361	13,032
Poultry	17,915	86	18,001	6,869
Pigs	2,219	40	2,259	5,385
Horses	110	2	112	40
Other Species	720	2	722	402
Miscellaneous	1,538	..	1,538	613
Total	54,787	593	55,380	55,417

Although the total of specimens received differed only slightly from those of the previous year, there were significant differences in terms of specimens from the various types of animal. The most important differences were reductions in the cattle, sheep, and pig specimens, and almost threefold increase in the poultry specimens.

At the Cattle Tick Research Station, Wollongbar, some 47,000 blood samples were tested for *Babesia argentina* and *Babesia bigemina*—in work associated with control of babesiosis in cattle in the Tick Quarantine Area.

TEST-MATING OF BULLS

All bulls intended for use at artificial stock-breeding centres in New South Wales are test-mated at the Veterinary Research Station, Glenfield, for diagnosis of possible genital infections. Also, whilst at the Station, bulls are tested for tuberculosis, brucellosis, leptospirosis, and contagious pleuropneumonia.

Seventeen bulls underwent such testing this year. Six of these were still under observation at the end of the year; and a bull already at an artificial insemination centre was taken to Glenfield and test-mated, with negative results.

Observations at the Veterinary Research Station, Glenfield, have shown that possibly 1 per cent of virgin heifers will give a transient reaction to the VMA test, giving rise to suspicion of vibriosis in the absence of the disease. Decoy females at the Graham Park Artificial Stock-breeding Centre were routine-checked. One animal gave positive reaction to the VMA test. Although the reaction was probably non-specific, the cow was removed from the insemination centre.

RABBIT MYXOMA VIRUS

This year 3,342 ampoules of myxoma virus, comprising 83,550 rabbit doses, were distributed. Of the total, 79,950 doses were distributed in N.S.W.—93 per cent in response to requests from Pastures Protection Boards. Consignments to the CSIRO, Australian Capital Territory, and Western Australia comprised 3,600 doses.

The increased demand for myxoma virus over the last twelve months in N.S.W. is illustrated by the next table:

MYXOMA VIRUS—REQUESTS AND DESPATCHES

Year	Despatched	Requests
1962-63	40,775 doses	295
1963-64	45,500 doses	344
1964-65	48,125 doses	373
1965-66	79,950 doses	356

Some co-operative work has been undertaken with the CSIRO Division of Animal Genetics to develop a more practical method of packaging the virus and a simpler means of introducing virulent virus to rabbit populations at more frequent intervals.

Stock Foods and Medicines Act

Stock-feed Registrations Approved, etc.—Applications approved for registration of stock foods totalled 2,104; submitted by 291 firms.

Registration was refused or deferred, pending receipt of further information or correction of labels, in 25 cases.

The number of applications for registration of stock feeds or licks containing urea sharply increased. Ninety-three such preparations were registered. Their urea content ranged from 0.25 to 30 per cent.

Dog-deaths on a Proprietary Food.—There was an extensive series of deaths of dogs fed a particular proprietary food. Symptoms suggested coumarin poisoning. Samples of the particular feed were tested at the Veterinary Research Station, Glenfield. Feeding the suspect-feed to day-old ducklings failed to induce toxicity, and led to the conclusion that aflatoxins were not responsible for the deaths of dogs. When the preparation was fed to mice, lesions consistent with coumarin poison resulted; suggesting that accidental contamination with rat-poison had taken place during manufacturing.

Piglet-deaths on a Proprietary Compound.—Because of a mortality in piglets dosed with a proprietary powder containing nitrohydroxyphenylarsonic acid, the product was tested. The mixture was found to be safe at the recommended dose rate, but analyses of tissues from the dead piglets suggested arsenic poisoning. Tests made with the measure, supplied with the powder, showed that it was possible for the animals to have received from 1½ to 6 times the recommended dose without undue carelessness on the part of the stockowner. Overdosing therefore probably accounted for the high tissue-arsenic concentrations found, as well as for the mortality.

Unsatisfactory Meat-meals.—Complaints of unsatisfactory results from use of some commercially-prepared meat-meals to stock, led to analyses of 15 samples of proprietary meat-meals. Only three of the samples were satisfactory. The remainder showed deviations from the expressed levels of protein, fat, and phosphorus.

The deviations extended to reduction in protein by as much as 7.2 per cent, and increase in the stated fat-content by as much as 52 per cent. Action was taken to ensure that future samples prepared by the firms concerned correspond to the stated level of ingredients.

Stock-Medicine Registrations Approved, etc.—The Stock Medicines Board considered 1,740 applications for registration of medicines. Registration was deferred in six cases. Applications were withdrawn in 65 cases. Provisional-registration, pending submission of additional printed-material was given in 115 cases. The remainder were fully registered.

The Stock Medicines Board required all preparations containing penicillin, streptomycin, oxytetracyclene for intramammary infusion in cattle, being sold without veterinary prescription, to include brilliant blue FCF as a marker dye.

Manufacturers of medicines were requested to submit their formulations in the metric system whenever possible, and to include in the metric system the quantities recommended for use.

Cattle Compensation Act, 1951–1962

Number of Claims.—Claims approved for payment totalled 7,014, as against 9,827 in the previous year. The total of cattle and carcasses for which compensation was paid was 10,644; a big reduction on the total of 14,835 for the previous year.

Diseases Concerned and Payments Made.—Disease for which compensation was paid and the amounts paid are set out in the next table:

Disease	Claims	Animals	Payments
			$
Tuberculosis	1,004	2,334	96,919.68
Cancer	3,471	4,547	132,374.53
Actinomycosis	2,176	2,538	64,103.65
Actinobacillosis	863	1,041	24,234.16
Pleuropneumonia Contagiosa	2	2	120.00
Trichomoniasis	..	..	..
Tick Fever	89	179	6,702.90
Johne's Disease	3	3	168.30
Vibriosis	..	..	..
Totals	7,608	10,644	$324,623.22

Claims Disallowed, and Reasons.—Claims for which compensation were disallowed were as follows: for delayed notification of disease by owners, 87; for failure to notify diseases, 35; for failure to pay levy or submit return, 26; and for delayed application for compensation, 2; total, 150.

In addition to those disallowed claims, the amount of compensation payable was reduced in 80 cases where claims were not submitted within 60 days of the slaughter of the cattle.

Compensation Fund.—Contributions to the fund showed a decrease of $98,557. This was in part due to a reduction in the levy during the year—from 10 cents to 5 cents per head of cattle; and in part due to a reduction in stamp duty revenue from cattle sales—affected by drought conditions. However, the fund received $40,000 representing interest on part of the fund's credit-balance held in fixed deposit by the Treasury.

Introduction of decimal currency necessitated a change in the proportion of market-value payable when disease is found on slaughter where cattle are ordered to be destroyed, and in the case of part-contamination of carcasses at abattoirs and slaughter houses. In the former case, the proportion of 7/8 was changed to 9/10; and in the latter case 1/6 was changed to 1/5, and 1/4 was changed to 3/10.

At 30th June, 1966, the credit balance in the fund was $1,467,163; compared with $1,570,888 a year earlier.

Board of Tick Control—Cattle Tick Control

ERADICATION MEASURES

Drake Area.—Examination at 21-day intervals recommenced on 1st November, 1965, and continued to 30th April, 1966. No evidence of cattle tick was found in this period. The Area is being maintained under surveillance.

Buccarumbi Area.—Two Areas, involved in the movement of tick-infested cattle from Grafton, were placed under eradication. The country was emptied of stock and is to so remain for fifteen months.

Kempsey Area.—An Area at Crescent Head, involved in the movement of cattle from Grafton, was similarly placed under eradication.

BABESIOSIS

Babesiosis remained the major problem. Nine outbreaks due to *Babesia argentina* were confirmed. In each case an animal died. One of these outbreaks occurred at Mullumbimby (Bangalow Section); four were in the Kyogle and four in the Tweed Area. The latter four cases were on properties near the Queensland border. Fifteen more infected properties were brought to light by the testing of cattle on properties adjoining those where outbreaks had occurred.

Successful control of outbreaks enabled most holdings to be released from quarantine on completion of twelve months of 14-day dippings and a negative complement-fixation test for the herd.

The position as at 30th June, 1966, was as follows:

Area	Outbreaks of Tick Fever 1964-65	Outbreaks of Tick Fever 1965-66		Tick Fever Holdings Released from Quarantine as at 30th June, 1966
	Holdings	Holdings	Stock	
Kyogle	87	19	2,510	73
Tweed	6	4	412	6
Richmond	3	1	92	3
Woodenbong	8	..	..	6
Totals	104	24	3,014	88

Extension of quarantine for a further three months was necessary on four holdings because the complement-fixation test undertaken on completion of twelve months' dipping revealed presence of carriers. Quarantine was extended for a further six months on seven holdings where full musters could not be obtained at each dipping.

During the twelve months, 44,521 cattle were subject to the complement-fixation test. In addition to the testing of cattle on infested and adjoining holdings, 3,661 head were tested before movement to Areas west of the Richmond Range and to the Grafton and Copmanhurst Areas. Testing of the moving cattle not only helped protect these areas, but also provided useful survey-information. No carrier was detected in this group.

CONTROL POLICIES

The 1965–66 policies were varied from the previous year, to reduce the risk of further tick-fever outbreaks.

Areas East of Richmond Range.—Within the Richmond, Tweed and Kyogle Areas stock on all holdings were given nine treatments at 21-day intervals between 18th October, 1965, and 22nd April, 1966. As in the previous year, owners were allowed to have calves under the age of three months examined instead of dipped, because of toxicity-problems with organic-phosphate dips.

In the same Areas, restrictions were imposed on stock-movement. Movements were permitted only subject to examination and treatment. This was action to reduce the possible spread of ticks. Because of the tick-fever problem, additional treatments were imposed where stock were being moved from Kyogle to other Areas.

The number of infestations detected was much less than in the previous year. But allowance must be made for the fact that there was no organized programme of examinations following the dipping-programme.

Infestations detected during the past four years have been as shown in the next table:

Area	1962-63	1963-64	1964-65	1965-66
Richmond—				
Bangalow	21	19	36	2
Lismore	19	24	75	9
Nimbin	13	13	20	8
Casino	40	67	108	20
Rappville	..	..	3	..
Kyogle	19	60	53	5
Tweed	7	12	33	3
Totals	119	195	327	47

Where heavy infestation was detected, there was usually a history of non-dipping of calves, or of incomplete musters—due to the rough country.

Areas West of the Richmond Range.—There was not an organized policy of treatments, but voluntary treatments were encouraged. A very limited number of stockowners volunteered. Stock being moved within the Areas were examined prior to movement, and in the Woodenbong Area were also treated.

The number of detected infestations showed an increase in the Tabulam Area. Several of these were heavy. Figures for infestations detected in the past four years are in the next table:

Area	1962-63	1963-64	1964-65	1965-66
Woodenbong	..	..	13	2
Bonalbo	..	1	4	1
Tabulam	2	1	2	11
Rivertree	..	1	..	..
Totals	2	3	19	14

Grafton and Copmanhurst Areas.—Following the detection of cattle tick in May, 1965, the Grafton Area was re-established. A policy of examination of all moving stock was introduced this year. In addition, the infested holdings completed four treatments at 21-day intervals and were then examined at 21-day intervals for the rest of the year. No further ticks were detected on these holdings.

In April, 1966, three holdings in the Palmers Channel Section of Grafton Area were found infested, and subsequently were treated in the same manner.

In the Copmanhurst Area a policy of examination of all moving stock was maintained. No evidence of cattle tick was found.

INSPECTIONS WITHIN AND OUTSIDE THE QUARANTINE AREAS

Examination of Stock at Abattoirs.—The policy of retaining inspectors at Grafton, Macksville, and Tenterfield Abattoirs was continued. Many *Haemaphysalis* and *Ixodes* ticks were found at Macksville and Grafton Abattoirs but no evidence of tick was detected at Tenterfield.

Inspectors were also stationed at Casino and Byron Bay Abattoirs within the Tick Quarantine Areas, primarily to examine calf-carcasses after skinning and remove any ticks found on the carcasses—but also to check on the movement and slaughter of cattle from tick-fever holdings and cattle brought in from clean country.

Examinations in Clean Country.—"Flying-gangs" operated in sections of clean country outside the Grafton Area, particularly at Buccarumbi, Chambigne, Halfway Creek, and Corindi, during February, March, April and May, and June. No evidence of cattle tick was found.

CLAIMS FOR COMPENSATION

Compensation claims were paid for the loss of 186 head of stock by death or injury during dipping operations. The payments totalled $7,538.93. The relevant figures were 280 head, valued at $12,305.40, in 1964–65.

FIELD OBSERVATIONS ON RESULTS OF DIPPING-OPERATIONS

Details have now been obtained of all losses that could be associated with dipping-operations and for which compensation was recommended on account of organic phosphate-toxicity. For comparison similar figures for 1964–65 also are quoted, in the next table:

Acaricide	Cattle Dipped		Mortalities		Losses per 100,000 Cattle Dipped	
	1964-65	1965-66	1964-65	1965-66	1964-65	1965-66
Asuntol	225,700	836,277	3	2	1·32	0·24
Delnav	3,114,500	2,941,495	200	66	6·5	2·25
Ethion	59,500	1,174,091	2	28	3·3	2·21
Sevin (Carbamate)	15,400	23,974	0	0	0·0	0·0
Trithion	37,000	21,152	2	0	5·4	0·0
Diazinon	55,500	..	1	..	2·0	..
Totals	3,507,600	4,996,989	208	96	5·93	1·92

Figures for the numbers of cattle treated for possible organic phosphate-toxicity are set out in the next table:

Acaricide	Cattle Showing Signs			Cattle Dipped 1-7-65 to 30-6-66	No. Treated per 100,000 Cattle Dipped
	Treated	Recovered	Died		
Asuntol	14	14 (100%)	0 (0%)	836,277	1·67
Delnav	246	218 (88·62%)	28 (11·38%)	2,941,495	8·37
Ethion	70	45 (64·29%)	25 (37·71%)	1,174,091	5·91
Sevin	..	..	..	23,974	..
Trithion	1	1 (100%)	1	21,152	0·47
Total	331	278 (83·99%)	53 (16·01%)	4,996,989	6·62

FENCING, DIP AND HUT CONSTRUCTION

The quarantine boundaries were maintained and improved by about 20 miles of new fence and 62 miles of extensive repairs to the existing fences. Of the total, 15 miles of new fence and 42 miles of repair-work were on the Grafton Quarantine boundary following re-establishment of the Area. Further progress was made in buffering the external boundary of the Rivertree and Woodenbong Areas.

The Dip Maintenance Gang was primarily employed in repairing dips in the Grafton Area. One new dip was built in the Grafton Area and one in the Bangalow Area.

Field staff undertook dip-repairs in all other Areas. Repair work was done on 457 dips, and 75 dip-yards were gravelled.

Four huts were constructed for staff; 20 huts were renovated and 42 were roofed.

STAFF NUMBERS

The Board of Tick Control started the year with a Ministerial staff of 466, and this had increased to 512 at 30th June, 1966. The 46 added were engaged for the re-established Grafton Quarantine Area and to control tick-fever.

During the year, 129 staff transfers were effected.

DIP AND TISSUE ANALYSES

The next table summarizes analyses carried out by the Board of Tick Control Laboratory:

Analysis	1965-66	1964-65
Dip samples	12,793	11,458
Hair samples	4,838	3,025
Animal tissues	600	793
Spray samples	117	127
Swab samples	94	. .
Totals	18,442	15,503

The quantity of paint manufactured was 640 gallons, as against 500 gallons in the previous year.

RESEARCH

Particulars of research undertaken by the staff of the Board of Tick Control Laboratory are incorporated in the Livestock Health Research Section of this Report.

Queensland Border Control

INSPECTOR TOTAL

Inspectors employed against introduction of Queensland cattle totalled 80. Of these, 66 were full-time and 14 were part-time employees.

STOCK MOVEMENT DETAILS

Stock moved *into New South Wales* totalled 238,866 cattle and 397,630 other animals; considerably fewer than in the previous year—due to drought. Stock moved *into Queensland* totalled 98,982 cattle and 1,090,994 other stock; considerably more than in the previous year. In terms of the three administrative sections—Stanthorpe, Goondiwindi, and Mungindi, the totals of stock which moved from Queensland to New South Wales and from New South Wales to Queensland are set out in the next table:

Administrative Section	Into N.S.W. from Queensland		Into Queensland from N.S.W.	
	Cattle	Other Stock	Cattle	Other Stock
Stanthorpe	164,125	66,575	29,698	516,238
Goondiwindi	55,870	174,235	62,648	397,023
Mungindi	18,871	156,820	6,636	177,633
Totals	238,866	397,630	98,982	1,090,994

NEW STOCK-CROSSINGS

Two new stock-crossings were gazetted. At the Wallangarra crossing, widening of the road to provide four traffic lanes is taking place. Improved lighting is also being provided. The Tenterfield Shire Council is doing the work.

NOXIOUS ANIMALS AND WEEDS

Rabbits were destroyed by fumigation, and blackberries by a hormone-spray, on the Wallangarra camping reserve.

OFFICE ACCOMMODATION; HOUSING; FENCING

Offices.—The office at Wallangarra was replaced by a new structure containing improved facilities. The Killarney Gate office was improved.

Housing.—Two new staff-cottages are under construction. Repairs and improvements were effected to twenty-four houses. Two new camping-units were erected. Improved amenities have been important to staff morale. There were fewer absences through injury and illness.

Fencing.—In Stanthorpe Section, 300 chains of new fencing was constructed. Also, 10 miles of rabbit and tick-control fence was re-constructed; half the cost borne by the Darling Downs–Moreton Rabbit Board. By using day-labour to construct new fencing, instead of contracts as formerly, the cost was reduced from $18.75 to $13.28 per chain. Clearing by bulldozing was done along some 30 miles of the border fence to permit vehicular-access. Part of this work was done in conjunction with the Darling Downs-Moreton Rabbit Board.

In the Goondiwindi Section, some 50 chains of new fencing was erected.

Meat Inspection Service

STAFF

Meat inspector establishment strength (all grades) at 30th June, 1966, was 199 including two vacancies. Brand-boy establishment strength was 20 including one vacancy.

JOINT INSPECTION BY STATE AND COMMONWEALTH

The Department's meat-inspectors and the Commonwealth meat-inspectors worked co-operatively at all export meatworks where State meat-inspectors are located.

The fact that Commonwealth inspection for export is a free service and the State service charges inspection fees to cover its costs has caused some problems in determining exemptions from State fees.

CARCASS INSPECTION TOTALS

	Cattle	Calves	Pigs	Sheep
State Abattoir	130,346	115,241	152,490	2,146,114
Other premises in County of Cumberland	49,019	37,820	21,213	1,075,641
Country Areas	765,719	295,758	395,192	4,258,579
Totals	945,084	448,827	568,895	6,481,334

TOTAL-CARCASS CONDEMNATION DETAILS

Reason	Cattle		Calves		Pigs		Sheep	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Actinomycosis	7	·001	1	..	..	..	..	..
Arthritis	75	·010	142	·036	1,310	·232	2,262	·041
Caseous lymphadenitis	..	..	..	..	..	..	2,918	·049
Cysticercus ovis	..	..	..	..	..	..	295	·005
Emaciation	1,284	·178	90	·023	30	·005	30,751	·513
Sarcosporidiosis	..	..	..	..	..	..	905	·015
Septic Conditions	227	·031	54	·013	550	·097	370	·006
Tuberculosis	709	·098	26	·007	215	·038	..	..
Other Conditions	931	·129	1,140	·286	474	·084	3,771	·062
Totals	3,233	·447	1,453	·365	2,579	·456	41,472	·691

PARTIAL-CARCASS CONDEMNATION DETAILS

Reason	Cattle		Calves		Pigs		Sheep	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Actinomycosis	13,263	1,839	15	·004	..	..	..	..
Arthritis	2,105	·292	57	·014	3,256	·576	8,398	·140
Caseous lymphadenitis	..	..	..	..	..	..	17,437	·291
Cysticercus ovis	..	..	..	..	..	..	..	..
Emaciation	..	..	..	..	..	..	..	..
Sarcosporidiosis	..	..	..	..	..	..	..	..
Septic Conditions	213	·030	10	·003	422	·075	268	·004
Tuberculosis	637	·088	2	..	826	·146	..	..
Other Conditions	6,486	·899	93	·023	7,329	1·297	5,045	·084
Totals	22,704	3·148	177	·044	11,833	2·094	31,148	·519

CATTLE-LIVER CONDEMNATIONS

Cattle-liver percentages condemned for various disease-conditions revealed by surveys at the State Abattoir were as follows:

Condition	1965-66 Per cent	1964-65 Per cent	1963-64 Per cent
Liver fluke	30·8	22·4	22·6
Hydatid disease	2·2	1·9	1·5
Telangiectasis	1·5	1·3	1·1
Abscess	1·3	1·4	1·5
Inflammatory lesions	1·4	1·4	1·6
Other Conditions were less than 0·1			

MISCELLANEOUS, MEAT INSPECTIONS

Re-inspection of meat introduced from outside the metropolitan area, and supervision of hygiene of transport and hygiene within premises, were carried out. A limited amount of butcher's shop inspection was also undertaken.

Antemortem inspections of cattle sold at the Flemington saleyards and pigs sold at Homebush Bay saleyards were regularly carried out, and all cattle brought into the State Abattoir were inspected before slaughter.

Services Under Commonwealth Quarantine Act

Division of Animal Industry continued to administer for the Commonwealth Government the animal-facets of the Quarantine Act 1908–1961. The work-volume continued the upward trend of recent years.

An additional port inspector was appointed to Sydney. Two veterinary officers and seven port inspectors now do quarantine work at Sydney and Port Kembla. The District veterinary officer and one port inspector do the work at Newcastle.

INSPECTIONS OF IMPORTS

Animals.—There was no change in legislation during the year. Importation of cattle, sheep, goats, and pigs into Australia remained totally prohibited.

Imports of almost all classes of animals were less than in the previous year. Exceptions were aquarium fish, animals for research, and horses from the United Kingdom.

Two deliberate attempts to smuggle birds into this State by plane from overseas were detected.

Animal Products.—Considerable increases were noted in the quantities of meatmeal, fishmeal, and stockfeed concentrates imported. This increase could be related to the drought.

Imports of cheese, milk products, tinned meats, and wool also increased. The import-quantities of feathers, skins, hides, animal hair, and both chilled and frozen meat, decreased.

Passengers' Baggage.—In the customs checks abundant salami and other types of meat, home-made cheese and other foods of animal origin were discovered in the baggage of migrants and others arriving from overseas. The luggage of one ship-passenger contained 90 lb salami, 5 lb bacon, and 65 lb home-made cheese.

Cases were discovered where raw wool and straw were used for packing. Each of these products could be contaminated with disease organisms. The articles so packed were destroyed, together with the wool or straw.

Illegal importations of food and other materials of animal origin constitute some of the most serious matters facing the Animal Quarantine Service. The problem is growing with continued increase in passenger arrivals. In 1965–66 there were 85,933 passenger arrivals by ship and 271,656 by aircraft; compared with 81,950 and 242,684 in 1964–65.

Parcels Post.—All sections of the Parcels Post Office, Railway Square, were transferred to the new Mail Exchange at Redfern, and the handling of quarantine-interest parcels has become more efficient. The volume of goods subject to quarantine continued to be considerable.

Parcels being cleared through the Newcastle and Port Kembla Post Offices were also attended to—the latter by periodic visits by Sydney Officers.

INSPECTIONS OF ANIMAL EXPORTS

Supervision of export of animals continued, involving stock inspection and, in some instances, treatment.

The number of horses exported increased. Main horse-exports were 80 to Hong Kong, 73 to New Zealand, 72 to Korea, and 58 to the Philippine Is. Increases were also noted with cats, dogs, aquarium fish, swine, and zoological animals.

Export of dogs showed interesting trends. In all, 1,317 were sent to 40 different countries; 356 to the U.S.A., 309 to Hong Kong, and 237 to New Zealand. There was an overall increase in dog consignments.

Export of pedigree dogs, comprising a large proportion of dogs sent overseas, is developing into a definite trade.

Day-old chick exports decreased for the second year in succession. Some 300,000 less than in the previous year were exported to Malaysia and Singapore. Chick exports to Fiji, New Caledonia, New Guinea, and New Zealand also decreased. After the discovery of a virus of Newcastle Disease in this State, each of these countries stopped importations when notified. But this does not explain the decrease in chick exports to Malaysia and Singapore, as these two countries continued to accept chickens from this State.

Cattle, sheep, and goat export totals also decreased.

INSPECTION OF LIVESTOCK SHIPS

All ships specially used for the carriage of livestock were examined for cleanliness and treated with an insecticide. As all vessels were clean, no further action was required.

DISINFECTION OF FOOTWEAR AND CLOTHING

The disinfection of footwear and work clothes owned by certain incoming air passengers continued as a precaution against introduction of the virus of foot-and-mouth disease. This year 962 shoes were disinfected, and 14 articles of clothing were detained for laundering.

SHIPS' PETS

Supervision over ships' pets on overseas vessels visiting Sydney and Newcastle was strict, as usual. There were occasions of instruction to ships' officers to tighten their precautions against escapes.

On four occasions the bond signed by a ship's master was estreated because the pet(s) had escaped. Escape of such animals, possible carriers of an exotic disease, is regarded seriously.

LIAISON WITH OTHER SERVICES

Good liaison and co-operation between the Animal Quarantine Service and the Department of Customs and Excise continued. A senior quarantine officer addressed customs officers at a number of customs-trainee schools.

Liaison was maintained, also, with the General and Plant Quarantine Services. Imported goods of dual interest were referred to the other service before release.

Livestock Health—Research

VETERINARY RESEARCH STATION, GLENFIELD

Actinomycosis Survey.—In an abattoir survey of suspected cases of antinobacillosis in cattle, cutaneous antinomycosis was diagnosed histopathologically at about the same frequency as cutaneous actinobacillosis. This is contrary to the accepted concept that actinomycosis is almost entirely restricted to bone and related tissues. The survey has not been completed.

Algal Poisoning.—Algal poisoning by *Anacystis cyanea* occurred again, in sheep at Armatree, in northern N.S.W. Toxicity of the water was confirmed by injections into mice. Naturally-infested water from the property was used experimentally on sheep, guinea-pigs, and mice.

Oral dosing of sheep with water caused chronic toxic hepatitis with jaundice developing over ten days. The same amount of infested water, treated by freezing and thawing, caused, when dosed to a sheep, acute, toxic hepatitis, with death within twenty-four hours of dosing.

Oral dosing of untreated and treated (ultrasonic disintegrated) water to guinea-pigs and mice had no adverse effect, but intraperitoneal injection of both untreated and treated water caused acute toxicity with indefinite pathological lesions.

Ataxia.—A problem long thought to be due to the ingestion of *Tribulus terrestris* was further studied recently, when two affected ewes were received at Glenfield from Tooraweenah. The condition has been under investigation since 1938, particularly on the property at Merrygoen, where it was thought to have caused death of 600 sheep in 1947.

Clinical signs appear to be constant. Affected sheep (usually in good condition) develop a peculiar ataxia on being driven. There is seeming weakness of one or both hind limbs, with swaying towards the affected side, and the sheep may go down when being driven. Sheep affected for some time develop characteristic ways of overcoming their disability, such as propping their hindquarters against objects. And affected sheep may progress in pairs—propping each other up. Sheep may be affected for up to two years before dying, usually of starvation.

On the Tooraweenah property the sheep concerned were bred on the property and were stud Border Leicester ewes; sixteen of fifty-four animals were affected this year. None of 500 Merino ewes run on the property were affected. And there was no growth of *Tribulus terrestris* on the property this year.

Of the two ewes received at Glenfield from Tooraweenah, one showed slight posterior-ataxia and left-sided paresis only. The other was in left lateral-recumbancy and had great difficulty in rising. She was unable to progress far or stand for long without propping her hindquarters against the fence, and she attempted to bear most of her weight on the forequarters.

On post-mortem examination, this ewe's musculature generally was not grossly abnormal but individual muscles appeared pale—especially in the left fore and hind limbs. The right fore limb appeared normal. Microscopically, no significant change was seen in the central nervous system nor in a large range of nerves including those to affected muscles. In affected muscles there were lesions of progressive degeneration comprising varying degrees of fibre-swelling, segmental necrosis, sarcolemmal proliferation and fibre regeneration.

The most severely affected muscles were seen in the left fore and hind limbs and included the teres mapor coracobrachialis, deltoid, thoracic trapezous, semi membranosus, semi tendinous and gracilis. In the right hind limb the gluteal muscles were severely affected.

In the worst-affected muscles there were almost no remaining normal fibres, and the lesions were certainly sufficient to account for the clinical signs. The severity of the lesions in the left fore limb was unexpected in the light of the clinical signs.

No explanation other than a genetic one presents itself.

Brucellosis (Sheep).—Export requirements of mutton to Germany are that sheep should not contain more than 30 I.U. of antibody to *Brucella abortus* per ml of serum. Sheep sera from abattoirs were surveyed. Of 1,314 sera collected, 114 were badly haemolysed and unsuitable for test; possible related to the unsatisfactory method of collection at slaughter, whereby watery fluid or ingesta gains access to the sample. The remaining 1,200 samples gave the following results: 1,188 contained not more than 25 I.U. of antibody per ml of serum; 12 contained more than 25 and three of the 12 contained 50 or more I.U. of antibody per ml of serum.

Chemical Research.—This work related to the significance of amino acids in nutrition, selenium interactions with sulphur amino acids in biological systems, and the pharmacological reactions of the "sulpha-drugs".

A new selective test has been developed for the detection of organic sulphur compounds separated by chromatography on paper or thin-layer. The technique has been published.

The principle has been applied to quantitative analysis of suitable materials, and a new method for determination of phenothiazine has been devised. This method has about five times the sensitivity of existing methods. It was applied to sheep to check on the proportion of the dose excreted in the faeces. As shown previously, the faecal excretion-pattern reached a peak concentration at about 15 hours, and returned to zero at about 60 hours after dosing.

The chemistry of sulphonamides has been studied in detail, including the establishment of ionization constants and spectral properties. Publication of these findings, and the chromatography of aromatic derivatives, contributes new knowledge of considerable significance to the pharmaceutical and rubber industries. It may lead to more intimate knowledge of the action of the "sulpha-drugs" biologically.

Dips (Cattle).—Dipping-trials were undertaken to determine the toxic levels of ethion for calves. No toxic effect was observed when calves were dipped three times at five-day intervals in a dip containing 0.05 per cent and 0.1 per cent ethion.

At 0.15 per cent two of ten calves died; one 12 hours after and the other eight days after the third dipping. Only the second calf showed symptoms of organo-phosphate poisoning. Tissue analyses have not yet been completed.

The Department was approached in regard to a test of specially selected resins capable of reducing the absorption of certain chemicals. If they proved effective in reducing absorption and retention of chlorinated hydrocarbons in tissue following dipping procedures, they could be considered in relation to pesticide residues.

Calf-dipping trials were undertaken, some calves being dipped in 1 per cent para-para isomer of DDT and others in a similar preparation to which was added the recommended quantities of selected resins. The residue level of tissues from all the dipped calves following slaughter was not significantly different between animals in the two groups.

Dips (*Sheep*).—Investigation of the chemical changes that occur in sheep-dips as a result of ageing and usage was continued in co-operation with officers of the Division of Science Services. One paper on diazinon and lime sulphur mixtures has been published. Others are being prepared for publication.

A number of insecticides have been examined in regard to the concentration required to destroy sheep body lice. The following proved efficient at the concentrations indicated: bromophos at 50 p.p.m., diazinon at 5 p.p.m., fenchlorphos (nankor) 50 p.p.m., formathion 500 p.p.m., coumaphos (asuntol) 50 p.p.m., carbophenathion (trithion) 50 p.p.m. None of these was toxic to sheep in the dip-concentrations used.

Systemic efficiency of cythioate was tested by oral administration. Although efficient for the sheep ked, it had little effect against lice.

Fluorescent Antibody Technique.—Satisfactory conjugates have been prepared against *Clostridium septicum, Cl. chauvoei* and *Cl. novyi.* These conjugates are being used successfully to diagnose Blackleg and Black disease infections—either by direct use of field smears or by identification of organisms recovered on culture. The application of the technique using frozen sections of both unpreserved and formalin-fixed tissues is under investigation.

A conjugate has also been prepared against *Cl. welchii* (Type D). Differentiation of the various types of *Cl. welchii* by this method will be attempted.

An apparently successful conjugate has been prepared against Swine Fever. Further critical examination of this has been deferred until a source of infective material is available in tissue culture. Material from infected pigs will only be used in the late stages of the work, owing to the cost of the animals for experimental infection.

Helminthosis (*Cattle*).—Ostertagiosis is being diagnosed with increasing frequency in cases of protracted diarrhoea in cattle. The condition presents serious diagnostic problems because of low to negative faecal egg-counts even when worm-burdens are heavy. A test for presence of plasma pepsinogen has shown promise of high specificity in the diagnosis of gastritis due to *Ostertagia* infection. This test is being developed as a possible research and diagnostic tool.

Dynamics of the host-parasite relationship in bovine ostertagiosis are being studied, with pure infections. Effect of size of larval-dose on incidence of arrested larval-development has been studied. Further observations on the dynamics of sequential dosing regimes are in progress.

Efficiency and toxicity of various anthelmintics for control of ostertagiosis have been studied in the laboratory and field. A field trial at Sutton, started in April, 1965, indicated that a single treatment with any one of three commonly-used anthelmintics was of little value in controlling ostertagiosis. A previous trial on the same property had confirmed the control value of several fortnightly anthelmintic treatments.

Incidence and abundance of internal parasites in cattle from birth to two years of age continued to be studied on the far north coast, supported by funds from the Australian Meat Research Committee. Seasonal changes in faecal egg-counts of various parasite species have been assessed, and worm-count information has been collected from groups of animals slaughtered at regular intervals. Faecal worm egg-counts in dairy calves have been much higher than those in beef calves. In each the most prevalent species have been *Cooperia punctata, C. pectinata, Haemonchus placei* and *Oesophagostomum radiatum.* Trematode parasite burdens have been low.

Continuing studies are designed to assess the importance of parasite-burdens, and the value of strategic anthelmintic-treatments, by comparison of body-weight changes in treated and control groups of cattle.

These observations will be extended to experimental herds in the New England and Riverina areas of N.S.W. in the coming year.

Helminthosis (*Sheep*).—A trial started at Trangie Agricultural Research Station in May, 1965, involved the study of the parasite-burden and growth-rate of two groups of crossbred weaners; a group treated monthly with thiabendazole, and a similar group untreated as controls, running as a single flock. Drought has restricted a worm build-up in the control group so that ova-counts remained low throughout the twelve months. Body-weight gains were almost identical in the two groups.

A Tenterfield trial, started in October, 1964, had to be ended prematurely in May, 1965, because of drought-severity.

At Shannon Vale Nutrition Station, Glen Innes, a trial ended at shearing time in September, 1965. The report is in preparation. The group of weaners maintained worm-free by regular thiabendazole treatment have throughout the trial grown faster, remained healthier and cut more wool than those in the untreated group.

Infectious Laryngotracheitis.—Further trials are being conducted to confirm the preliminary and promising results of the value of iodine in the drinking water as a means of prevention of spread of I.L.T. The use of iodine as an aerosol in reducing the spread of respiratory diseases is under investigation.

Lice (*Cattle*).—Two groups of twenty Galloway cross weaners lightly infested with lice were used to assess the efficiency and residual effect of diazinon treatment and the effect of lice on bodyweight gain. One group was sprayed twice at an interval of thirteen days with 0.02 per cent diazinon, and the control group with water. The groups were run together and weighed at monthly intervals for five months. Lice populations did not build up on the control beasts. Lice were eliminated from the diazinon group but reinfestation occurred three months after treatment. At the end of the trial the degree of infestations was similar in both groups. There were no significant differences in bodyweight gain between animals in the two groups.

Mastitis (*Cattle*).—The total of milk samples examined was 528 and, of these, 277 (52.4 per cent) contained sufficient inflammatory cells to indicate mastitis. The following bacterial isolations were made from the samples submitted:

Haemolytic Staphylococci—	
coagulase positive	139
coagulase negative	17
Non-haemolytic Staphylococci	53
Haemolytic Streptococci	43
Non-haemolytic Streptococci	4
Haemolytic *Escherichia coli*	1
Corynebacterium pyogenes	4
Bacillus subtilis	9
Non-haemolytic Coliforms	8
Micrococcus candidus	7

The results from antibiotic sensitivity tests of numbers of the organisms are listed in the next table:

Antibiotic	Haemolytic Staphylococci		Haemolytic Streptococci	
	Number tested	Percentage sensitive	Number tested	Percentage sensitive
Penicillin	174	69·0	38	100·0
Streptomycin	174	90·8	38	94·7
Tetracycline	174	97·7	38	100·0
Oxytetracycline	138	97·8	34	100·0
Chlortetracycline	138	100·0	34	100·0
Chloramphenicol	174	100·0	38	100·0
Erythromycin	174	100·0	38	100·0
Furazolidone	174	100·0	38	97·4
Spiramycin	174	98·8	38	100·0
Nitrofurantoin	49	92·2	4	100·0
Ampicillin	49	92·2	4	100·0

Newcastle Disease.—From pathological material, four isolations of Newcastle disease virus were made in embryonated eggs.

Isolates have been identified by the inhibition of their haemagglutinin by a rabbit serum prepared against the Albiston and Gorrie strain by the CSIRO. In each case the degree of inhibition corresponded to that shown by this serum against the haemagglutinin (formalinized) of the Queensland V4 strain.

Isolates have been compared in terms of embryo mortality, consistency of haemagglutinin production, and stability of haemagglutinin to formalin and to 56° C. There appear to have been at least two clearly distinguishable strains of NDV recovered.

A trial to assess the pathogenicity and natural transmissibility of one strain for hens, chickens, turkeys, and ducks has been commenced. Results are not yet available.

Periodic testing is being carried out on a group of mature hens which contain a high proportion of haemagglutinin-inhibition (H.I.) reactors. Observations have been made over several months. Interim results indicate a slight fall in titres and no evidence of spread of infection.

Pathological and virological observations are being conducted on a group of young hens divided into 12 pens. The results of initial H.I. tests indicated that some spread of infection had occurred after the establishment of pen groups. Interim results do not indicate any material alteration in the serological status of these birds.

Observations are being made on chickens, the progeny of both reactor and non-reactor hen flocks, from day-old through normal rearing procedures on a property maintaining a reactor-flock.

One preliminary and interesting finding has been the low incidence of detectable reactors in the day-old progeny of the reactor-flock.

Organic Phosphate Toxicity.—After investigations by Dr Endrejat of Bayer-Leverkusan into toxicity that followed field use of the drench, rametin, collaborative trials were designed. These were to investigate the possible relationship between malnutrition and enhanced toxicity.

Trials under varying nutritional regimes were set up, using debilitated sheep from drought-stricken properties where toxicity had occurred. Progressive sampling was undertaken to determine the changes in serum protein and albumin, GOT and bilirubin levels. In all, 150 samples were examined.

In general, the results indicated a critical level of malnutrition in susceptible animals. And a very rapid return to "normal" tolerance after improvement in the nutritional state. From circumstantial evidence produced during the work by Dr Endrejat, an unidentified component in sheep nuts fed at maintenance level to debilitated sheep appeared to increase susceptibility.

Depression of cholinesterose levels was demonstrated at the Bayer Laboratories, in affected and unaffected sheep, as could be expected with a drug of this sort.

It is postulated that severe malnutrition inhibits synthesis of cholinesterose, thus preventing correction of the effects of the drugs. The effects of the sheep nuts are unknown, as no work was done to determine effects on blood-ammonia levels or liver function.

Pullorum Disease.—Reactors to the pullorum-test were detected in a few presumed pullorum-free flocks. In other flocks, reactor-incidence showed an unexpected increase over earlier test-results. Some practitioners who test under the Pullorum-Certified Scheme also were worried by the marked increase in fine, atypical reactions.

Reactors from various flocks are being submitted to Glenfield for bacteriological examination to confirm field-test results. When all results are available they should be useful in comparing the reliability of rapid-tests conducted in field and laboratory and the serum-tube tests with actual isolation of *Salmonella pullorum*. Already it seems apparent that *S. pullorum* strains used in the preparation of stained antigen and tube-test antigen should be standardized.

A number of *S. Pullorum* strains have been sent to the Commonwealth Serum Laboratories to see whether "variant" strains are present in N.S.W. flocks.

The rapid slide-test on blood was found unreliable in chicks under two weeks of age, presumably due to failure to produce sufficient antibody to react. Definite post-mortem lesions were found in most cases where six or more chickens were submitted as a group. Lesions in the myocardium were most frequent. *S. pullorum* was recovered from all cases showing lesions of pullorum disease and from two cases not showing lesions. No abnormal biochemical reactions of the isolates were observed.

Two trials of the influence of furazolidone on pullorum infection and serology were completed. In the first, furazolidone was at the 0.04 per cent rate in the feed for ten days. In the other, furaltadone was given in the drinking water at a similar concentration for ten days. Difficulty and delay were incurred in getting enough birds known to be infected with pullorum. Eventually only 16 birds were available for each trial; eight treated and eight as controls. Neither medication in the feed nor in the water effectively eliminated infection in any bird. *S. pullorum* was recovered in all birds at slaughter some five and four months respectively after th drug had been administered. No consistent effect on th agglutination titre was caused by medication in either th feed or drinking water.

Toxicity of Cotton Fireweed.—Cattle mortalities in the Upper Hunter and Merriwa Pastures Protection Districts du to cotton fireweed (*Senecio quadridentata*) led to a trial o the worst-affected property. This was to ascertain the effec of cobalt in preventing pyrrolizidine alkaloid poisoning i cattle. One group of 25 yearling cattle was given two cobal bullets and was run together with a group of 25 similar bu untreated yearling cattle on *Senecio quadridentata*-infeste country.

Owing to the drought which prevailed from the trial's outse in March, 1965, there was little growth of *S. quadridentata* or any pasture. It was necessary to slaughter 20 animal in each group in May, 1966. Liver sections from each beas were examined. Most of the treated animals had retaine their cobalt bullets, but there was minimal evidence o pyrrolizidine alkaloid intake in all the liver sections. N animal was more than mildly affected, and there was n difference between the groups.

Several cows from other paddocks had died during the year Pyrrolizidine alkaloid poisoning was diagnosed on liver pathology.

The remaining five animals in each group are now running on a neighbouring property heavily infested with *S. quadridentata*. The treated animals have received another two cobal bullets in March, 1966.

Vibriosis (Cattle).—Investigations continued re maintenance of specific *Vibrio fetus* antigen for vaginal mucus agglutination (VMA) tests. A preponderance of short forms having been found desirable, a satisfactory procedure to eliminate most long or chain forms without significant loss of short forms was evolved.

After the usual washing and centrifuging, the cells were resupended in 0.3 per cent formol saline to an opacity of B.W.2. After 48 hours standing at room temperature the supernatant fluid was drawn off carefully and centrifuged at high speed. The sediment then being resuspended, as above, and again left standing. There was then very little sedimentation. This antigen proved entirely satisfactory for VMA tests after many weeks' refrigerator-storage.

Examination of a large percentage of specimens submitted to Glenfield and to other laboratories from suspected cases of infertility has failed to reveal a specific aetiology. To improve laboratory-diagnosis, work is proceeding on better staining methods, on clearing of thick mucus smears, and on use of millipore microbial filters of different pore sizes to separate slow-growing vibrios from the more rapid ones.

Vitamins.—Chromatography of Vitamin E and beta-carotene in feed, serum, and faeces has now been applied to sheep in preliminary digestibility-studies, and to five species of fodder plants.

Considerable variation in both carotene and tocopherol contents (20-77 mg/lb and 4-37 mg/lb resp.) has been demonstrated between species of plant.

In lambs maintained for six months on a ration containing no detectable alpha-tocopherol, measurable quantities were excreted in the faeces. When these lambs were placed on a diet of freshly-cut green-feed containing 20 mg/100 g alpha-tocopherol, the faecal concentration was as high as 90 mg 100 g (both on dry-matter basis).

Beta-carotene at 0.1 mg/100 g and 27.8 mg/100 g in the feed of sheep resulted in faecal concentration of 1-4 mg/100 g and 90-100 mg/100 g respectively.

CATTLE TICK RESEARCH STATION, WOLLONGBAR

Tick Ecology.—Larval-migration of the cattle tick (*Boophilus microplus*) by wind-assisted movement over pasture has been confirmed and further studied. In favourable situations a very small part of a large population was shown to move as far as 100 feet. In timbered country, movement rarely exceeded 12 feet.

Larval-migration as unattached passengers on birds and mammals was also demonstrated, for distances in excess of 200 yards.

It is clear from the tick-history of the Queensland Border that such movement must be rare. But the findings offer an explanation for many of the outbreaks of fever.

Overwintering of ticks has been studied in greater detail and at new sites—Tabulam and Grafton. Each of these two districts appears to be less unfavourable to tick egg-development in winter than had been expected. The surface-soil is slightly warmer than had been thought.

Acaricide Application.—Work has been concentrated on asuntol and ethion. Information on these was the most pressingly needed, having in mind efficiency against ticks, safety to stock, and cost.

Repeated tests have shown that artificial rain, one inch in one hour, or a 12-second swim through water for treated cattle, has remarkably slight harmful-influence on the treatment. Further tests are needed, under varying conditions. But at present it seems, for these medicaments, dipping-effect would not be reduced by rain or by need to ford flooded creeks—provided that after the dip half an hour lapsed before the water was applied.

Toxicity.—After a case of poisoning by ethion-dip, the Research Station put five herds through rigorous tests. With the bath at normal strength they were given, respectively: 16 dippings in 76 days; 18 in 54 days; 14 in 25 days; 14 in 25 days, and 30 in 101 days. The cattle showed no symptoms of intoxication. They improved in condition during the dipping schedule, because feed was improving. The latter two herds had blood-tests. These showed depression of enzyme level, which apparently was not at the danger point.

The opinion that the medicament was a relatively safe one, was confirmed by later wide-experience in the field.

Head Wetting.—Experiments towards ensuring that every animal in a dipped herd might be guaranteed completely-wetted were continued. Devices developed have reduced the number of partially-dry heads but 100 per cent cover cannot yet be guaranteed.

Spraying.—Spraying is known to be less effective than dipping for eradication when the walk-through spray-race is used. Recent trials have shown that the hand-operated power-spray may be as effective as dipping, provided great care is taken.

Advantages are that special animals may be treated with a small quantity of prepared fluid. Disadvantages are that the fluid required per beast and the time needed per beast are increased about 10 times as compared with normal dipping; and the job, to be effective, must be done by a thoroughly trained and careful operator.

BOARD OF TICK CONTROL—RESEARCH LABORATORY

Depositing Power of Dipping-Baths.—Field observations in 1964–65 showed very varied deposits on the hair of delnav-dipped cattle.

The chemist has developed a method to determine the depositing-powers of dips on hair. A quantity of new cattle-hair is dunked in the dip-sample whilst this is being mechanically stirred, then the hair is dried, a portion is weighed, and the amount of acaricide is estimated by I.R. spectroscopy. The results compare satisfactorily with field-results.

The test was done on most of the delnav dip samples submitted in 1965–66. For one group of 1,195 samples, collected over eight months from dips in Bangalow Area the results were: 34.7 per cent of samples, above 4.0 mgm/gm delnav; 51.2 per cent of samples, between 4.0 and 1.0 mgm/gm delnav; 14.1 per cent of samples, below 1.0 mgm/gm delnav.

Other work had shown that high hair-deposits were associated with organic phosphate-toxicity in dipped cattle. Initially an arbitrary figure of 10 mgm/gm was considered dangerous and anything over 6.0 mgm/gm as high. Subsequently a figure of 4.0 mgm/gm was regarded as high. In cases of excessively high hair-loadings, action was taken to convert the dip from delnav to ethion.

Because of the importance of controlling hair-deposits, the effect of scooping a dip at rest was investigated. The results indicated that scooping lowered the level of hair-deposits without affecting dip-concentrations. Action has now been taken to have dips showing hair-loadings of over 4.0 mgm/gm scooped before use. This work has indicated also that dip-concentration does not control hair-deposits.

The twelve months' observations indicate the need to continue the policy of checking hair-deposits of all delnav dips. As ethion is also an emulsion-dip similar precautions will be taken with it.

The chemist is examining the possibility of doing this work in connection with all dip-samples in the coming year. The observation that low hair-deposits do occur may be important to acaricidal-efficiency and this needs further investigation.

Ethion Safety-study.—A group of calves under three months of age were dipped six times at five-day intervals, in a dip concentration of 0.075 per cent ethion. No symptom of organic phosphate-toxicity showed and the treatments had little effect on cholinesterase levels.

Adult cattle were dipped 14 times within 25 days in 0.069 per cent ethion. These animals showed no evidence of toxicity. Whole-blood cholinesterase levels were lowered but not markedly.

Delnav Safety-study.—To investigate toxicity of delnav two different dips were used; one with high hair-depositing power and one considered to have normal depositing power. The trial confirmed that toxicity depended on the amount of active ingredient deposited on the hair. Under the condition of the trial there was marked depression of whole-blood cholinesterase in animals that showed symptoms of organic phosphate-toxicity.

The CHE level of cattle with very high hair-deposits was markedly depressed. Twenty-seven days after dipping this level had not reached pre-dipping level. The CHE level of cattle with normal hair-deposits was not so markedly depressed. Also, recovery to pre-dipping levels was more rapid.

Residues in Dairy Products.—Six butter samples were examined for DDT and delnav residues. One showed presence of DDT 3 mg/kg. None showed delnav.

In a trial to determine the level of asuntol in butterfat, cattle were dipped in asuntol emulsion 0.018 per cent. Mean figures from four individual animals were as follows: five hours after dipping, 1.97 mgm/kg; one day after dipping, 0.77 mgm/kg; two days after dipping, 0.30 mgm/kg; three days after dipping, 0.09 mgm/kg.

Residues in Meat.—Random fat-samples collected at abattoirs within Tick Quarantine Areas yielded the following results: DDT, 17 samples, one with 1.0 mgm/kg; BHC, 10 samples, all nil; delnav, 14 samples, six with 0.1 to 0.3 mgm/kg.

In a trial to determine the level of asuntol in fat of cattle dipped three times at five-day intervals in asuntol emulsion at 0.026 to 0.032 per cent, the results were as follow:

Mean figures	1 Day	4 Days	7 Days post-dipping
Kidney Fat	0·42	0·26	0·17 mgm/kg
Subcutaneous Fat	0·70	0·22	0·17 mgm/kg

Ethion Micro-estimation Method.—After a long investigation the Laboratory is now able to undertake by gas chromotography the micro-estimation of ethion in animal fats below 1.0 p.p.m.

Ultra-Violet Spectroscopy.—Considerable success has been achieved in the use of ultra-violet spectroscopy for estimation of a number of pesticides containing aromatics or other compounds that give rise to the ultra-violet spectra. The method has been developed for tissue residues of sevin, bromophos, nankor, and asuntol. It is proving very useful for this kind of estimation. The large signals given in the ultra-violet spectra by this class of compound make it possible.

Livestock Husbandry—Research

SHEEP RESEARCH—TRANGIE AGRICULTURAL RESEARCH STATION

Selective Breeding of Merino Sheep.—The single-character selection-flocks continued to demonstrate the high heritability of fleece weight and its components, although only crimps per inch and staple-length were important in the fleece-weight increase in the "Fleece Plus" flock. Selection for skin-folds caused a small increase in greasy-fleece weight, but was associated with low yield—so no advantage was obtained in clean-fleece weight.

Among the commercial demonstration flocks, the Selection Demonstration flock (recommended breeding-plan) produced 20 per cent more clean wool than the flock from which it originated. The Stud flock produced 9 per cent more than the Selection Demonstration flock. This was 19 per cent more than the stud produced last year and was the highest it has ever reached. Much of this advantage was due to a higher level of skin-folds, although staple-length and probably density also contributed.

Nutrition and Stud Ram Production.—Progeny-testing of two groups of Stud rams was completed. One group had been raised and shedded under a Stud-plane of nutrition. The other was raised on typical paddock-grazing. Progeny of the Stud-plane rams averaged 9.01 lb greasy-fleece weight. The Trangie-plane averaged 9.10 lb. This result shows that the environment under which rams are raised has no influence on the wool production of their progeny.

Evaluation of South Australian Merinos.—Bungaree South Australian Merinos grew 23 per cent more clean wool than comparable Peppin Merinos—due to their longer, thicker wool-fibres and their greater size. The fertility of these sheep was raised to more normal levels (83 per cent lambs born) by joining in April instead of February-March.

In an extension of this South Australian Merino evaluation, a flock of Collinsville Merinos (an intermediate type) was bought. This flock was the best producer during the drought. It cut 46 per cent more wool than the control flock of Peppins. The added production was due mainly to larger size and fibre-volume. The fibre-volume was between that of Bungarees and Peppin Merinos, and probably to an advantage in fibre-density.

Shearing Bungaree South Australian Merino ewes in December (before mating) increased the number raddled during a four-week mating period in March. It also improved the proportion of ewes conceiving to the first service. Shearing in June (before lambing) increased birth-weight of lambs by 4 per cent but did not lower lamb-losses up to weaning.

Dual-shearing increased wool production and improved the quality of the wool. But returns were lower than for ewes shorn once in the same twelve-month period. Shearing in December increased the wool-growth of all ewes, whereas June shearing had a similar effect only on the non-pregnant ewes.

Weaning-Weight Selection-Flocks. — Feeding experiments showed that sheep selected for different weaning-weights maintained different mature bodyweights but that maintenance-feed needs were the same per unit of bodyweight. The flocks also differed in wool production, in proportion to bodyweight—so there was no difference in efficiency of wool growth.

The conclusion was that weaning-weight need not be considered in a Merino breeding programme aimed at increasing wool production, either per head or per acre. But some selection for this character may be useful in producing crossbred sheep. To examine this point the flocks have been joined with Border Leicester rams, and the relative production of their crossbred progeny will be evaluated.

The "Lustre" Mutant.—"Lustre" is a dominant gene affecting the fleece of Merino sheep. Although a dominant gene, lustre and normal matings have given a segregation ratio which differs significantly from the 1:1 expected. The ratio observed is 1.2 normals : 1 lustre. The lustre gene decreases birthweight by 10–15 per cent and increases lamb mortality, especially the deaths before or during birth of small lustre-lambs. The gene decreases fleece weight by decreasing primary and secondary follicle density, and by reducing fibre length. Lustre animals have poorer jaws than normal Merinos, and much less skin fold; and a greater expression of horns among the ewes.

Early Nutrition and Adult Performance.—Ewes were given different nutritional treatments, one restricted and one superior, between four and fourteen months of age. These treatments produced 30 per cent differences in bodyweight at fourteen months. Bodyweights and clean and greasy-fleece weights were adversely affected in the low-plane group. But the low-plane ewes lived as long as, were wet more often and weaned more lambs than the high-plane ewes.

Lambing-Management Systems Compared.—The Fertility flock was divided into two groups of about 170 ewes each. One group lambed under close supervision in the drift lambing system. The other group was not supervised during lambing in a large paddock. Thirteen per cent of lambs born in the drift died before weaning, compared with 22 per cent in the unsupervised group. Of the lambs that died in the drift, 62 per cent died before marking at five days of age and 38 per cent died between marking and weaning.

In the unsupervised flock, 58 per cent of the dead lambs died between birth and marking at three weeks of age, while 42 per cent died between marking and weaning. No ewe died in the drift system, while two died in the unsupervised flock.

Face-cover and Performances.—Contrary to earlier reports from Australia and overseas, work carried out in several areas of New South Wales in the course of co-operative field-investigation projects has shown little association between face-cover and reproductive performance or face-cover and wool production of Merino ewes when face-cover is scored at the two-tooth joining.

Twinning and Performances.—In the course of co-operative field-investigation projects in two districts single-born Merino ewes have been shown to weigh markedly more than twin-born ewes at marking. Though this difference was reduced substantially by weaning, twins were still lighter due to smaller frame-size and poorer condition-score. But in one of these districts, there was at the two-tooth shearing only a 4 per cent difference in wool production. This was in favour of the single-born ewes. When weighed shortly after shearing, the original 27 per cent difference in bodyweight had been reduced to 3 per cent.

Shorn v. *Unshorn Lambs.*—Again in the course of co-operative field-investigation projects: Shorn carry-over lambs had heavier increases than did unshorn lambs, but net economic-return favoured the unshorn lambs by a small margin. The shorn lambs were penalized by lower net-returns from wool and skins and because a greater number of their carcases were heavier than the economic-optimum for carcass value. The conclusion was that maximum advantage may be gained by shearing all lambs, and slaughtering them as they reach the carcass-weight that gives maximum net economic return.

Productivity of Natural Annual Pastures and Lucerne.—Since May, 1965, forty dry ewes have been rotationally grazed through 10 x 1 acre paddocks at an overall stocking-rate of four dry ewes per acre. This is four times as heavy as the accepted, district stocking-rate—one sheep per acre on natural pastures.

There was a gradual fall in bodyweight throughout the late winter, but the sheep did not fall below 85 lb. There was a rapid rise in bodyweight in spring. Excessive growth in spring and early summer was utilized by introduction of more sheep. Thus, from October to January, the stocking-rate was 6.5 sheep per acre. The ewes were joined in autumn and they will be carried on the same 10 acres until their lambs are weaned next spring.

Efficiency of Wool Production.—The difference in wool growth between the Trangie "Fleece Plus" and "Fleece Minus" Selection flocks is largely due to a difference in efficiency of conversion of feed to wool. But the extent of the difference in efficiency is modified by the level of nutrition and is least at low-feeding levels. Some experiments have been started, to determine the metabolic pathways whereby these efficiency differences and the interaction occur.

To ascertain whether differences exist between the flocks in deamination reactions in the rumen, supplements of casein were given to half the trial sheep from each group. Wool growth and bodyweight reactions show that the supplementary protein was deaminated to the same extent in both flocks. So it is unlikely that intra-ruminal differences are the cause of different amounts of protein reaching the abomasum.

Further work has been done on the follicle density-fibre diameter relationships involved in the differences in wool growth, and their interaction with nutritional level. At present it appears that the greater follicle density of the "Fleece Plus" sheep results in relatively greater competition per follicle for wool-substrate at low nutritional levels than occurs in "Fleece Minus" sheep. Thus, differences in fibre diameter are small —despite the fact that one flock has a greater potential for expression of fibre diameter.

By changing the sheep to a high level of nutrition, the competition among follicles becomes less intense. Then the "Fleece Plus" sheep express their potential for large fibre-diameter. This relatively greater change in fibre diameter would result in the genotype x environment interaction, in wool growth and in efficiency, observed in earlier experiments.

Environmental Influence on Ram Fertility.—This study is proceeding, also, at the CSIRO Laboratories, Prospect. Selection of Merino rams for increased skin-fold ("Folds Plus") has been found to be a simultaneous selection for rams unable to remain fertile during summer. Rams selected for low skin-wrinkle ("Folds Minus") remain fully fertile during summer.

"Folds Plus" rams suffer summer-infertility through an inability to keep the temperature of their tests low enough to permit normal spermatogenesis. This in turn is solely due to low thermoregulatory efficiency of the scrota of "Folds Plus" rams.

This association was also present in the CSIRO's independently established flocks at Cunnamulla. It suggests that selection for increased skin-fold is a major factor reducing reproductive performance in regions where Merino rams are mated during or soon after hot summers.

SHEEP RESEARCH—CONDOBOLIN AGRICULTURAL RESEARCH STATION

Border Leicester Improvement.—Five hundred and ten half-bred ewes were joined with ten twin- or triplet-born Border Leicester rams in 1965. The lambing results were 85 per cent wet ewes, 64 per cent multiple births, 143 per cent lambs born and 127 per cent lambs weaned. The proposal is to maintain or increase this high level of fertility while breeding back to the Border Leicester, by breeding only twin-born rams and by rigorous culling among the ewe flock.

Seven- to ten-month-old ewes were also joined and there was an association between bodyweight and lambing performance. Lambs that weighed less than 45 lb at joining averaged only 38 per cent wet ewes. Lambs weighing more than 50 lb averaged 69 per cent wet ewes.

SHEEP RESEARCH—COWRA AGRICULTURAL RESEARCH STATION

Hybrid Vigour in Lamb Production.—There were considerable differences in carcass weight and composition between the parent breeds and reciprocal-cross lambs. But there was no evidence of hybrid vigour. However, when the F_1 ewes were joined with Dorset Horn rams, hybrid vigour had big effects on reproduction and neonatal mortality. In this case, hybrid vigour increased the number of wet ewes by 9 per cent, increased the number of multiple births by 11 per cent, and reduced neonatal mortality by 32 per cent—a total 50 per cent increase in lambs marked.

There was no evidence of hybrid vigour in the carcass characteristics of the F_2 lambs.

Castration and Nutrition re Growth-rate of Lambs.—Overseas and in Australia the use of entire males or partial castrates has been suggested to increase meat production. Experiments here over the last four years have shown that the lamb-growth mostly is not sufficiently fast to denote economic advantage by altering present methods of castration.

SHEEP RESEARCH—GLENFIELD VETERINARY RESEARCH STATION

Breed Maintenance Levels of Feeding.—This project has proceeded, also, at Temora Agricultural Research Station. The aim has been to determine the maintenance level of feeding for Corriedale, Polwarth, and Border Leicester x Merino wethers.

Final results showed that Polwarth wethers could be maintained at 80 lb on 4.7 lb of starch-equivalent per week, while Corriedale wethers required 5.1 lb of starch-equivalent per week to be maintained at 90 lb. Thus, the maintenance-feed costs of both breeds were about the same per pound of body weight.

Protein Levels at Maintenance Requirements.—With Merino, Polwarth, and Corriedale wethers, there was no significant effect of protein on maintenance requirements or on bodyweight loss or gain when the sheep were fed iso-caloric diets. Wool-growth of sheep which experienced small losses in bodyweight was not affected by the protein-content of the diet, provided a period had been allowed for stabilization of wool-growth. However, when sheep made rapid gains or fell rapidly in bodyweight, the protein-content affected wool production. A delayed response of nutritional level was observed in most groups.

Studies of body composition *in vivo* showed that as bodyweight fell, body-fat was reduced, while the percentage of body water and protein increased in a similar manner. The results indicated the need of further study of some aspects of body composition before survival requirements can be more accurately determined.

SHEEP RESEARCH—LEETON AGRICULTURAL RESEARCH STATION

Affecting Fertility in Border Leicester x Merino Ewes.—The effect of nutrition during winter and spring on the start of the sexual season of Border Leicester x Merino ewes was studied in 1965. Nutritional treatments were established by using different stocking-rates. Differences in bodyweight between groups were extreme, but there were only minor differences in start of the sexual season. This began in all groups in October.

Use of intravaginal sponges impregnated with 6-methyl-17-acetoxy progesterone (MAP) to induce breeding in anoestrus Border Leicester x Merino ewes is being investigated. After sponge-withdrawal, the ewes were injected with 1,000 I.U. of pregnant mares' serum (PMS). Half of the ewes were given a second PMS injection 16 days after the first. Three classes of ewes were included in the experiment: aged, lactating ewes; maiden, 18-month-old ewes; and maiden, 12-month-old ewes.

Treatment of aged, lactating ewes resulted in a reasonable proportion of pregnant ewes; 14/21 for ewes receiving 1 PMS injection, and 16/21 for ewes receiving two PMS injections. Results of the treatment of the other two classes of ewes were less satisfactory. Only seven of 86 ewes conceived as a result of the first PMS injection. In the ewes receiving a second PMS injection the number of pregnant ewes appears to have been increased (from 3) to 23 of 43 ewes.

Season of Drop, and Joining in Border Leicester x Merino Ewes.—The start of the breeding season in two groups of spring-born and two groups of autumn-born ewes was observed between 1962 and 1966. The observations showed that season of drop did not effect the time of commencement of breeding season. However, commencement of breeding season became increasingly earlier up to 20 months of age. Beyond this age the two factors were independent.

Shearing-time re Border Leicester x Merino Ewe Production.—Production from Border Leicester x Merino ewes, shorn either pre-lambing or pre-mating, has been compared over two years. The effects of the time of shearing were studied for both summer and autumn joinings.

Pre-lambing shearing was not detrimental to production of wool and lamb. There were some beneficial effects. Ewes shorn pre-lambing produced more lambs through an increased twinning, and produced less tender and cotted fleeces. There was also a small increase in greasy-fleece weight for the ewes shorn pre-lambing and autumn-joined, compared to the ewes shorn pre-mating and joined at the same time.

Autumn-Winter Nutrition of Breeding Ewes on Irrigation.—Production of autumn-lambed ewes stocked at three and six per acre on sub clover-Wimmera rye pastures was studied in a pilot-experiment. Also, the value of a supplementary area of paspalum-white clover pasture (one-fifth of the total area) was assessed.

Per acre production of lamb and wool were greater at six ewes per acre, but production per animal was less. At three ewes per acre, the summer-pasture supplement did not increase production, in either year. But at six ewes per acre, the summer-pasture supplement increased production in the second year.

At stocking rates of up to three ewes per acre, pasture management is unlikely to affect production. The point at which pasture management begins to exert an influence lies at a stocking-rate between three and six ewes per acre.

Feed Intake of Early-Weaned and Suckling Lambs.—An experiment was carried out to measure the pasture-intake of early-weaned and suckling lambs, and to determine whether early-weaned lambs could sufficiently increase intake to compensate for the loss of milk from their diet.

Measurements of pasture-intake and ewe milk-production were made at 9, 12, and 16 weeks of age. The weaned lambs increased intake by 75 per cent, 19 per cent, and 16 per cent above that of the suckling lambs at these times. Growth-rate from birth to 16 weeks of age was 0.55 and 0.62 lb/day for weaned and suckling lambs respectively.

This experiment was repeated with some lambs dosed with selenium and/or vitamin E. Once again, early-weaning decreased growth-rate and carcass-quality. Dosing with vitamin E or selenium gave no advantage. It may actually have depressed growth-rate.

SHEEP RESEARCH—TAMWORTH AGRICULTURAL RESEARCH STATION

Dorset Horns v. *Border Leicester x Merino Ram.*—Carcass-weights of lambs sired by Dorset Horn rams were 7.7 per cent heavier than those of lambs sired by Border Leicester x Merino rams ($P < 0.01$). These results contrast with the previous joining in this trial, when there was no difference between the performances.

SHEEP RESEARCH—TEMORA AGRICULTURAL RESEARCH STATION

Breed-Productivity, Comparison Trial.—The productivity of flocks of Corriedales and Polwarths has been compared at Temora Agricultural Research Station in 1963 and 1964.

Corriedale hogget ewes had higher clean-fleece weights, and longer wool staples, but fewer crimps per inch. The Corriedale flock also had more wet ewes and multiple births, and fewer lambs were lost to weaning. Corriedale lambs were heavier at birth and at weaning. Return per mated ewe favoured the Corriedale by 22 per cent.

Urea Block Feeding.—The nutritional value of two types of urea block was investigated, using penned sheep. One block contained a low amount of urea (7.1 per cent) and high energy in the form of sorghum grain and molasses distiller's solubles. It stimulated intake of a roughage of 2.3 per cent crude protein to the extent of 2.6 times that of unsupplemented sheep. The block prevented deaths, maintained sheep at a constant weight and increased wool-production. When the block was fed with a roughage of 5.1 per cent crude protein, bodyweight gain and wool production were greater than for an unsupplemented group.

Until more is known of the amount and distribution of low-protein pastures, it would be unwise to infer that comparable field-results will be obtained.

The only significant effect of the other block, which contained 30 per cent urea, was to increase the number of survivors in the group fed the low-protein roughage.

SHEEP RESEARCH—SHANNON VALE NUTRITION STATION

Poor and Improved Merinos at High and Moderate Stocking-Rates.—Breeding ewes from the Trangie "Fleece Plus" and "Fleece Minus" Selection flocks are being run in two contrasting farmlets. One farmlet is running six breeding ewes per acre, the other is running two breeding ewes per acre. During the drought year, normal fertility was exhibited by the ewes at the low stocking-rate. There was serious decline in fertility among the ewes on the high stocking-rate; their weaning percentage was only 32 per cent. In this regard, there were no differences between the "Fleece Plus" and "Fleece Minus" flocks.

Superphosphate- and Stocking-Rates.—Wethers in this trial are set-stocked at three superphosphate levels (½, 1½ and 3 cwt per acre) and three stocking-rates (4, 8 and 12 wethers per acre). No major trend attributable to superphosphate dressing has yet been identified. But it was notable during the drought that mortalities generally occurred first at the ½ cwt superphosphate level.

Continuous v. *Rotational Grazing.*—A four-paddock strategically-grazed system is being compared with continuous grazing at three stocking-rates (4, 8 and 12 wethers per acre). There are two replicates. In terms of wool production and feeding-costs, there appears to be little difference between these management systems at any stocking rate.

Production of Sterile Rams and Wethers on Improved Pastures.—Sterile rams have been grazing with wethers, in a study of wool-production in relation to posthitis-incidence. Twelve of the nineteen wethers experienced mild posthitis. But there was no difference between the rams and wethers in wool production.

SHEEP RESEARCH—YANCO AGRICULTURAL RESEARCH STATION

Breed Comparisons for Meat Production.—This experiment is in association with Leeton Agricultural Research Station, and in two phases. The purpose of the first phase, at Yanco Agricultural Research Station, is to compare Border Leicester, Cheviot and Merino rams in terms of meat production, and to produce first-cross ewes for evaluation as prime-lamb mothers at Leeton Agricultural Research Station.

The wether-portion of the first-cross progeny is slaughtered at 4–5 months of age, and assessed in terms of total meat production, quality, and financial return.

Two years' results show Border Leicester- and Cheviot-sired lambs to be superior in all aspects to Merino-sired lambs. Border Leicester-sired lambs returned 50 cents more per lamb than Cheviot-sired lambs in 1964 but there was no difference in 1965.

The ewe-portion is joined to Dorset Horn rams at 18 months of age. From results available, the Border Leicester x Merino ewe is already showing superiority in terms of wool, fertility, and growth-rate of lambs.

SHEEP RESEARCH—PRIVATE HOLDINGS, YASS VALLEY

Investigations into Statistics of Yass Valley Merinos.—This project, commenced in 1965, has proceeded along two main lines: (*a*) definition of the problem of low lamb-marking percentages; (*b*) observations on lamb-and weaner-growth as affected by time of lambing and different species of summer forage-crops.

Observations on sample-flocks of ewes from twelve properties showed the main factor influencing variation between properties in lamb-marking percentages to be lamb-mortality (c. 22 per cent lambs born). The proportion of ewes lambing (c. 90 per cent of those mated) was satisfactory. The proportion of multiple births was low (less than 10 per cent of ewes lambing). This, though not causing much variation in the area, is undoubtedly an important factor in the low, overall lamb-marking percentage.

Autopsies on dead lambs revealed that "starvation" (c. 44 per cent of lambs which died) and "exposure" (c. 31 per cent) were the most important causes. Deaths due to predation (c. 10 per cent), "dystokia" (c. 8 per cent) and "infection" (c. 5.1 per cent) were of less importance.

Time of lambing was the most important factor governing lamb-weight at the end of spring. Growth rates were similar on different properties, and amongst the early- and late-drop lambs on each property.

At seven weaners per acre, set-stocked on 2-3 acre plots, Japanese millet gave greater weight-gains (20 lb) than lucerne (19.7 lb.) and sudax (13.6 lb) in the period mid-January to mid-April. Native pastures at even lower stocking-rates gave gains of only 5.3 lb over the same period. At higher stocking-rates, 15 and 22 per acre, weight-gains were only of the order of 3 to 6 lb despite availability of appreciable feed on some plots.

BEEF CATTLE RESEARCH

Pasture Digestibility Study.—At Leeton Agricultural Research Station the effect of top and bottom fractions and the whole of an annual pasture, on the faecal nitrogen-digestibility relationships, have been studied.

Steers were fed cut-pasture to establish a regression of faecal nitrogen-digestibility per cent. This was to enable estimation of the digestibility of pasture consumed by cattle grazing a similar pasture. This will be used, with the chromic oxide method for estimating faecal-output, to determine the amount of feed eaten by steers on irrigated pasture. The three pasture components were examined to study the influence of leaf and stem on the faecal-nitrogen concentration and organic-matter digestibility.

The study was from May to November, on subterranean clover/rye grass pasture. There is a seasonal decline in faecal-nitrogen concentration associated with decline in digestibility of the pasture from September to November. There does not appear to be a real difference in the top-bottom or whole components. A more simple digestibility trial will suffice in further work.

Performances of Weaners on Long and Short Pasture Swards.—Significant differences in bodyweight gain of Angus weaners on long and short swards ($P < 0.01$) were reported in 1964. The trial was repeated during 1965 using Hereford weaners but did not confirm those differences.

Steers were dosed with chromic oxide in selected periods as part of the method to estimate pasture-intake.

Beef per Acre on Irrigated Pastures.—Sub-optimal growth in cattle grazing irrigated pasture has been previously reported from Leeton Agricultural Research Station. To assess the regional extent of this, cattle-growth data are being recorded on commercial farms in the Murrumbidgee Irrigation Areas. This work also complements the intensive study of seasonal organic-matter intake of cattle grazing irrigated pastures at the Research Station.

Early results indicate that seasonal and overall bodyweight-gains in cattle grazing on commercial farms are similar to those at the Research Station. However, in one case, when weaners were introduced from a drought area, they gained 2.5 lb per day over a six-months period.

Treatment for internal parasites was introduced in three cases. There was no significant response. This confirms earlier studies at the Research Station.

Performance-Recording of Beef Cattle.—This project has been developed on private properties under the Agricultural Extension Grant. The aims have been to:

Record the performance of beef cattle, in terms of economically important production-traits.

Examine the inter-relations between these.

Develop selection-procedures to maximize production in beef-breeding herds.

The procedure developed is that the animals are weighed and graded on conformation at strategic periods in their life, viz., weaning and yearling.

Weaning-weights are adjusted for age, sex, and age of dam. These adjusted weights and grades are graphed and the calves and their dams rated. Initial culling is done using this information. Then replacement bulls and heifers are selected on their yearling weights and grades.

Data from progress in one of the herds illustrate the marked improvement that can be achieved.

In three years the weaning weight of calves over the whole herd increased by 15 lb.

Bulls gaining 0.5 lb per day faster than their contemporaries, sired progeny which as yearlings were more than 30 lb heavier than the progeny of the slower-gaining bulls.

The use of such top-gaining young bulls and the culling of replacement-females on their first calf-production has been practised for six years, and as a result, maiden heifers are now weaning calves over 30 lb heavier.

Conformation grade has also improved from C+ to B—.

Direct measurement of production is replacing some of the old standards used for judging and selection of breeding-animals. Bulls are actually priced and sold on their weight-for-age and conformation grade in a number of the demonstrations.

Bulls sold on this basis from one of the herds have gone to at least five studs. These studs in turn are instituting similar production-testing schemes. Production-tested bulls have been sold to more than 80 commercial herds.

Beef Cattle Improvement Through Breeding-Methods.—This project was started in the Angus stud at Trangie Agricultural Research Station in 1963:

To demonstrate within a top stud the application of selection-procedures designed to increase genetic-progress for important production traits.

To isolate superior genetic-material for the beef industry.

At the 1965 auction of young bulls, factors other than weight gains and conformation largely influenced prices paid. Lower prices and lack of competition were in general experienced throughout the industry. But at the first sale, in 1964, over 60 per cent of the variation in price arose from differences in weight-gain. The differences between bulls ranged up to 0.4 lb per day. For every 0.1 lb per day that a bull gained within this range, the purchase price increased by $134.

DAIRY CATTLE RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Pasture-Evaluation for Dairy Cow Nutrition.—Studies to determine the feeding value of legumes, grasses and mixtures and the effect of stage of growth on feeding value were continued, using wethers in metabolism cages. The factors measured have been voluntary intake, digestibilities of dry matter, crude protein and energy, and nitrogen balance.

The feeding value of *Glycine javanica*-kikuyu and *Desmodium uncinatum*-kikuyu pastures were assessed in a voluntary intake and digestibility experiment. The results confirmed earlier impressions that *Glycine-kikuyu* pastures have slightly higher feeding value than *Desmodium*-kikuyu pastures of virtually the same legume-grass ratio.

The value of nitrogen-topdressed kikuyu grass as a winter pasture has been assessed, using wethers. Despite a poor growth-rate, the digestibility-coefficients were relatively high and the animals were always in a positive nitrogen-balance.

An experiment was set up to determine the voluntary intake of a *Glycine javanica*-grass pasture by stall-fed dairy cows and their milk production. By use of monozygous twin cows, the intakes and milk production of cows pasture-fed and of cows lucerne hay/meal-fed were compared.

Pasture was cut twice daily and was fed green *ad libitum*. The hay was offered *ad libitum* after meal was fed at the rate of 4 lb per 10 lb of 4 per cent fat-corrected milk (F.C.M.) produced daily. The trial was conducted over nine weeks starting one month after calving. Digestibilities of the diets were determined by using wethers.

The voluntary intake of pasture and of lucerne hay/meal by the cows was 32.0 and 36.2 g D.M./Kg respectively. The milk production was 18.0 and 40.0 lb 4 per cent F.C.M. respectively.

Feed-Year Production Trial.—The feed-year production trial using a pasture system of four acres of *Glycine javanica,* five acres of subterranean clover and five acres of vetch on a 24-acre grass-dominant farmlet has been completed.

In each of the three years, the cows on the feed-year system produced more milk-fat per cow and per acre than the control cows on an unimproved farmlet.

The trial showed the value of integrating tropical and temperate species into a system to provide continuous high-quality feed for dairy cows. But it was possible also to determine periods of the year when the feed-year system failed to provide sufficient quantity and quality of pasture.

New pasture-systems, based on a high level of development with tropical legume/grass pastures, and supplementation of these pastures with temperate species and nitrogen fertilizer, are now being tested.

Spring-Calved and Summer-Calved Cows on Glycine javanica/*Vetch Pastures.*—*Glycine javanica* was established over the entire area of two 15-acre kikuyu grass-dominant farmlets and about 20 per cent of each farmlet was sod-sown with vetch.

Despite the incomplete lactation of the summer-calved cows, the milk-fat production per acre of both spring-calved and summer-calved cows has well exceeded that of cows on the unimproved, control farmlet. The spring-calved cows produced 132 lb milk fat per acre whereas the control cows yielded 76 lb per acre.

Another time-of-calving comparison is proceeding, using pastures of tropical and temperate species with nitrogen fertilizer.

Milk-Yield from Nitrogen-Topdressed Grass Pastures.—A trial was started in September, 1965, to measure milk production from a mixed kikuyu (*Pennisetem clandestinum*)/pasalum (*Paspalum dilatatum*)/carpet grass (*Axonopus affinis*) pasture topdressed with 300 lb N per acre and grazed at stocking rates of 1⅓, 1, and ⅔ cows per acre. The nitrogen-application rate was inversely proportional to the pasture-growth rate, with the pasture topdressed on six occasions from September to May.

Butterfat production from November, when the stocking-rate treatments were imposed, to June was 151, 174, and 154 lb per cow, and 200, 174, and 103 lb per cow at the high, medium, and low stocking-rate, respectively.

From the start of the trial in September, 1965, to June, 1966, the butterfat production average of all treatments was 205 lb per cow and per acre. These figures contrast with butterfat production 181 lb per cow and 76 lb per acre (at 2.4 acres per cow) on similar but unfertilized grass pastures.

PIG RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Feeding Levels.—Statistical examination of the results of studies previously undertaken has now been completed. The work has revealed:

(1) Level of feeding had little effect on efficiency of feed-utilization. Efficiency of feed-utilization was adversely affected on rations containing high proportions of crushed wheat to skim milk.

(2) On any particular level of feeding the replacement of 1 lb of crushed grain for 1 gallon of skim milk was insufficient to maintain daily gain. In order to maintain a given daily gain, 1.4 lb of crushed wheat was required to replace 1 gallon of skim milk.

(3) Increased level of feeding was associated with decreased carcass-lean content. Thus, high levels of feeding while producing rapid liveweight-gains resulted in low-quality carcasses.

Three Growth-Curves to Bacon Weight.—A study was made of the performance of pigs growing to bacon-weight along three growth-curves: slow-fast, medium-medium, and fast-slow. Each of the three treatments was designed so that all pigs would be the same age at slaughter. But this requirement was not actually met. The pigs on the slow-fast curve took longer than anticipated to reach bacon-weight.

While carcasses from all treatments were of high quality, those produced on the fast-slow and medium-medium curves contained more lean and less fat than those from the slow-fast curve. The feed-efficiency of pigs grown along the fast-slow curve was inferior to that of pigs on the other two treatments.

Characteristics of Commercially-Graded Carcasses.—Eight carcasses from each of three commercial grades were examined for characteristics. Grading by visual estimation of depth of fat on the split carcass separated the carcasses into three grades. Backfat measurements in these, taken at four standardized positions, differed significantly between the grades. Internal fat and fat plus skin depths taken over the longissimus dorsi muscle also differed between grades.

Premium-grade carcasses contained a higher percentage of muscle and bone and a lower percentage of fat than carcasses of first and second grades. Per cent middle increased and per cent ham decreased from first through to third grade.

Value of Kikuyu Grass for Pregnant Sows.—Kikuyu grass value as a partial substitute for meal in the diet of pregnant sows has been studied over four gestation periods. The reproductive performance of the Large White sows and gilts used in this study was not adversely affected by substituting kikuyu grass for 50 and 40 per cent respectively of the meal ration allotted during pregnancy. However, sow body-condition was affected to the extent that ultimately the reproductive performance may have deteriorated.

Thus, kikuyu grass, at a stocking-rate of approximately 13 sows per acre was not capable of supporting the same overall-performance as 2 lb meal-equivalents.

Farrowing Accommodation.—Piglet-losses in the first three days of life were studied, using four different types of farrowing accommodation. The first type was an open-fronted pen equipped with farrowing rails; the second type was similar except that part of the front of the pen was enclosed by a 3-ft 6-in wall; the third type was similar to the second except that a hurdle was placed diagonally across the pen. A round-house built to the ground-plan specified by the Ruakura Agricultural Research Centre, New Zealand, was the fourth type. Heat lamps were provided in each pen and most of the farrowings were supervised.

No difference in piglet losses was observed between pens in the first three days of life. Records of farrowings at Wollongbar in open-fronted pens without heating lamps revealed that 9.4 per cent of pigs alive at birth were lost in the first three days of life. In the new pens these losses were reduced to 5.9 per cent.

The results indicate that a well-designed shed, with a heating lamp and supervision at farrowing, will reduce losses in the first three days after birth.

Dietary Calcium Levels.—Dietary calcium levels of about 1.2, 2.4, and 3.4 per cent were studied for their effect on pig performance. The basal-diet (1.2 per cent calcium) contained wheat, meatmeal, and fishmeal and the higher-calcium levels were achieved by adding limestone. Pigs were individually housed and fed twice daily at the daily rate of 3.5 per cent of bodyweight. The pigs were slaughtered at about 90 lb liveweight.

On each of the two diets involving added calcium the daily gain and efficiency of feed-conversion were significantly decreased. There was no significant effect on the per cent lean in the ham nor was there any evidence of the disease parakeratosis.

POULTRY RESEARCH—SEVEN HILLS RESEARCH STATION

Breeding Project (Eggs).—The current egg-breeding programme was commenced in late 1959. It includes three egg-production flocks (Australorp, Leghorn, and synthetic) and three corresponding control flocks. Between 2,000 and 2,300 pullets are tested in single-bird cages each year. Selection is carried out with September-hatched chickens, on egg-production to the end of June. This year, the breeding was by artificial insemination.

In the past year, an average gain of 10.62 eggs per generation was made, and over the past three years the average gain has been 6.91 eggs per generation.

Breeding Project (Meat).—The fifth selected-generation of the programme was hatched in November and December, 1965. Average gains of 0.23 and 0.17 lb per generation were made this year in the E and D flocks respectively. This is the first year that a randomly-selected control line has been used to gauge progress. Gains per generation indicate that simple mass-selection is adequate at present.

Antibiotics in Poultry Diets.—Reduced response to penicillin, fed as the farm antibiotic since 1950, led to testing of other antibiotics. Of those tested, lincomycin's effect declined in a successive experiment. A mixture of penicillin and bacitracin was no more effective than bacitracin alone.

Meatmeal Investigations.—A wide range of meatmeals, from various manufacturers in New South Wales, have been analysed for crude protein, calcium, phosphorus, fat, ash, bone, sodium, potassium, free fatty-acids and hot water-soluble protein. Chick-assay data were also collected for these meatmeals.

Correlations between the growth-response and chemical composition of the different meatmeals are being calculated.

Growth-depression by high calcium may be the effect of pH changes on intestinal absorption. Conflicting results have been obtained with milk powder when used to prevent growth-depression by high calcium.

High levels of meatmeals appear to have no limitations in laying-diets, while knacker-meal appears satisfactory for chicken-growth. Fishmeal produced a significant response, compared with meatmeal.

Unidentified Growth-Factors.—The traditional sources of unidentified growth-factors were examined. The lowest levels of fishmeal and milk powder producing optimum responses were recorded.

Commercial sources of U.G.F. were also tested. Fishmeal produced by the Cavanagh-process was found equal to the imported product in feeding value. However, corn liquor did not produce a growth stimulus.

Wheat-Protein Level.—High-protein wheat (18–19 per cent) was tested against 11–12 per cent protein-wheat for growth-depression and effect on feed-conversion.

Significant growth-depression was associated with the high-protein wheat. Supplementation with lysine and arginine did not show these amino acids to be the only limiting factors in the high-protein wheat. Feed-conversion followed the same pattern as growth-depression.

Grain Sorghum-Toxicity for Chickens.—Early research indicated a toxic effect of grain sorghum when fed to chickens. Later experiments did not confirm this.

Livestock Husbandry—Field Activities

SHEEP AND WOOL SECTION

General.—Extension activities in this severe drought year have been specially directed to advice on hand-feeding and the related problems of management in the conditions. Short schools on drought-feeding, and comprehensive use of press, radio, and television enabled widespread dissemination of the information and advice.

Despite the problems caused by drought, steady producer interest has been maintained in higher stocking-rates. Inquiries are consistently received about new methods of management and stocking. The sheep and wool officers find that their rural community is showing greater appreciation of research and more readily co-operating with trials and introduction of new ideas.

Demonstrations as Extension Media.—Continued emphasis has been placed on field demonstration and investigation projects as extension media. These are "testing" research findings at district and farm levels and also promoting adoption of recommended improved methods of stock and pasture management.

Each district livestock officer (sheep and wool) has been equipped with sheep-weighing scales, purchased with funds from the Australian Wool Board. It is basic equipment for proper recording of any stocking or management demonstration.

Activity Statistics.—The following is a summary of activities comparing 1964–65 and 1965–66:

	1964-65	1965-66	Percentage increase or decrease
			per cent
Number of property visits	2,014	2,603	+ 29·6
Number of sheep ranked on production	192,732	149,689	— 22·2
Value of sheep selected for purchase	$245,214	$150,153	— 38·6
Lectures, Demonstrations and Field Days	277	274	— 0·17
Ram Sales, Agricultural Shows, etc., attended	126	126	. .
Radio, Press and TV	447	429	— 4·5
Competitions conducted	36	30	— 16·7
Field Investigations	29	52	+ 80·5

The reductions in "number of sheep ranked", " value of sheep selected for purchase", and "competitions conducted" directly reflect the drought. The increase in "property visits" also was an effect of the drought. The near to 80 per cent increase in "field investigations" reflects the trend towards extension through field demonstration and trial units that permit repeated observations and field discussions by the rural community.

Merino Ewe Competition.—Drought conditions affected entries. These are well down on previous years. The judgings are in progress.

Sheep Breeders Ewe Fertility Competition.—The spring-lambing section was cancelled because of the drought. Support for the competition has declined. The conditions will be reviewed before recommendations likely to affect continuation of the competition are made.

Fleece Measurement Service.—This service was commenced in 1962 to promote the use of clean-fleece weight in final selection of reserve Merino rams. Finance for the service is provided by the Australian Wool Board. The complement of three officers was this year reduced to two, as it was found that the two—with assistance by district sheep and wool officers—could cover the needs. The number of samples received for measurement decreased but the number of studs using the service was maintained at the previous year's total.

A survey was done to determine the likely continuing call on the fleece-measurement service by the Merino stud industry. The survey showed that an increase in number of samples submitted can be expected in the next three years; probably 15,000 samples if no charge is made, or 11,000 samples if a charge is introduced. Introduction of a charge per sample is proposed for introduction in 1967–68, as it is thought that the industry should contribute to help meet the cost of this service.

Flock-breeders have readily accepted selection by greasy-fleece weight. Stud-breeders are more gradually accepting the general practice of selection-by-measurement with modifications.

In-Service Training.—Three livestock officers (sheep and wool) attended the Department's Extension Methods School. Fourteen officers enhanced their experience at the Sydney Sheep Show and Sales. Three young officers received training in lamb-grading with district officers.

The annual 4-day seminar for sheep and wool officers was held at Yanco. The theme was "Prime-lamb production, with special emphasis on irrigation management". Speakers from the CSIRO, the University of Sydney, and this Department contributed. Others who attended included research personnel working in subject areas relevant to the industry, and the sheep and wool lecturers of the Hawkesbury, Wagga, and Yanco Agricultural Colleges.

In October, 1965, a symposium on "drought feeding of sheep" was held; to review present knowledge, determine its adequacy for presentation through extension channels and recommended avenues for further research. All District sheep and wool officers, and research officers working in the field, attended. The symposium recorded 39 items to which additional research attention should be directed.

A convention for professional sheep-classers was organized by the Dubbo District sheep and wool officer, to review current research on Merino breeding and to effect closer liaison between this group and research and extension officers. The convention was well attended by well-known and influential members of the profession. There were representatives of all States.

The sheep-classers formed an Association and propose to organize a similar convention each year.

Sheep Numbers.—Decrease in New South Wales sheep numbers has been estimated at 12 million—by mortalities, sale for slaughter, and loss of lambs through no breeding. This would be about 16 per cent of the State's total of sheep. In the previous severe drought, 1945–46, the drop in sheep numbers approximated 23 per cent. Recovery from that took seven years. Assuming that the current drought conditions break during the 1966 winter-early spring, it might take five to six years for the New South Wales sheep population to regain the 1965 total of 72 million.

Production Trends.—No marked change has occurred this year, other than as dictated temporarily by drought.

Spring-lambing and autumn-shearing have been generally adopted. Use of the Border Leicester x Merino ewe and Dorset Horn ram for prime-lamb production is firmly established; other breeds being used only in isolated cases. Interest in management systems to lift stocking-rates is abundant and on the return of better pastoral conditions will continue.

In the West Wyalong/Lake Cargelligo districts the heavy-cutting strong-wool South Australian type sheep are being used increasingly each year, due to the comparative lower wool-price and the difference between prices of medium and strong wool.

The drought has highlighted the value of lucerne as pasture, and of irrigation. District officers report increasing requests for information on irrigation-management in relation to sheep industry.

Sheep at Departmental Institutions.—The total of sheep at Departmental institutions at 30th June, 1966, is 21,291; compared with 25,595 at 30th June, 1965.

PIG SECTION

Industry Production.—Very satisfactory prices for pig meats ruled throughout the year. Production increased with the keener interest. The most recent available pig-population figures indicate that in March, 1965, there were more than 8,000 brood sows in production. The figures also indicated a trend to bigger rather than more herds.

Production is now at an extremely high level and most pigs are being slaughtered at porker-weight, so production has not yet exceeded demand. Bacon and ham production has been able to meet demand but supplies of baconer pigs have not been excessive. Indirectly, restrictions on movement of pigs through saleyards have helped price levels to hold.

Departmental Herds.—Large White, Berkshire, Landrace and Tamworth breeds were maintained at the Hawkesbury, Wagga, Wollongbar and Grafton institutions. The Hawkesbury and Wagga College herds were used mainly for student-instruction and rations. The Wollongbar and Grafton herds were used for nutrition and carcass research. New bloodlines were introduced to the Hawkesbury and Wollongbar herds, and programmes of culling the aged or unsatisfactory brood-stock proceeded.

The institutions disposed of 1,346 pigs; as against 1,064 in 1964–65 and 855 in 1963–64. Each herd was more productive on lower brood-sow numbers.

Statistics of Extension and Regulatory Services.—The activities of livestock officers' extension and regulatory services for the pig industry are summarized in the following table, with comparisons from 1963–64 and 1964–65:

	1963-64	1964-65	1965-66
Farm visits	1,380	1,707	1,564
Meetings attended	52	61	68
Pig sales attended	169	189	150
Field days	14	17	32
Bacon factory and abattoir visits	74	101	66
College and Research Station visits	85	58	74
Shows attended	21	19	17
Lectures and demonstrations	64	82	84
Swine Branding Act, 1940, inspections	61	47	19
Stock Food and Medicine Act inspections	14	..	17
Press statements	41	54	113
Radio and television contributions	83	72	113

Also a constant stream of requests for advice on all phases of pig production was dealt with by in-person interviews, by letter and by telephone; and the comprehensive range of printed pamphlets on the breeding, feeding, housing and marketing of pigs was in keen demand and widely distributed.

School for Pig Raisers.—A successful School for Pig Raisers was held at Hawkesbury Agricultural College. This school attracted sixty-seven applications of which forty were accepted from all parts of the State.

In-Service Training.—The training of juniors as livestock officers for pig-industry services continued at the departmental institutions where there are pig herds. The junior officers also attended the "School for Pig Raisers" as part of their in-service training—gaining in particular from the contacts there with commercial pig-producers.

The 1965 Conference of Pig Production Officers was held at Grafton Research Station. All Livestock Officers (Pigs) attended.

Swine Compensation Act.—Assistance was given in the preparation, examination and processing of many claims arising from orders for pigs to be destroyed and carcasses condemned. At 30th June, 1966, the credit balance of the Compensation Fund was $336,479, compared to $200,944 at the outset of the twelve months. Receipts had totalled $148,701 and expenditure, $13,166 in the period.

Swine Branding Act.—During the year 1,078 new brands and forty-two new licenses were issued. Brands transferred to new owners totalled 156. The *Index to Brands* issued under this Act has proved most useful in the field. It has been kept up to date at all centres, through circulated information of newly-issued brands and transfers.

Assistance to Other Departments and Organizations.—Technical advice on management of pig herds maintained at their institutions was given to the Departments of Prisons, Health, Education and Child Welfare. Breeding-stock was supplied to them as required. Department of Technical Education was also assisted by part-time teaching in Technical College and Correspondence Courses in pig raising.

The livestock officers' services were called on by various farmer organizations and the Junior Farmer Club movement, the Australian Pig Society, the Royal Agricultural Society of N.S.W., numerous country Show societies and the Rural and Commonwealth Development Banks.

BEEF CATTLE, HORSE AND GOAT SECTION

Beef Industry Trends.—Beef cattle wastage in New South Wales has been heavy, through the drought. This will be reflected for four to five years after the drought has really broken. Fortunately for industry, prices on the home and export markets have remained high. The return from all classes of cattle sold for slaughter has been exceedingly good.

Statistics of Extension Activities.—The following is a summary of the extension service activities:

Radio broadcasts	61
Telecasts	28
Meetings	59
Conferences and symposia	26
Schools for beef cattle producers	20
Field days	54
Farming properties visited	811
Press statements	numerous

In-Service Training.—The practice of sending newly-appointed officers to large beef cattle stations in Northern Australia for a type of industry-induction training that cannot be obtained in the south has been continued. At present two officers are on Northern Territory properties for about nine months of this special experience.

Young officers are being trained to fill established District positions.

The Section now has livestock officers in eight of the nine Agricultural Regions.

Agricultural Extension Grant Demonstrations.—Provision for two more demonstrations has been made, using funds from this grant. Demonstrations under this grant are based on genetic improvement in the beef cattle herds concerned. Their type is such that they can be maintained although the pastoral conditions are extremely adverse. But in some cases the number of cattle involved has had to be reduced. This will not negate the objectives or procedures.

Except for one project, dealt with in the research section of this report of the Division of Animal Industry, the demonstrations have not yet progressed far enough to show the aimed-at genetic results. But the inevitable close supervision of stock in the demonstrations has led to improved husbandry and attendant results.

Beef Cattle Breeders' Competition.—The 14th Annual Beef Cattle Breeders' Competition ensued, collaboratively with the Rural Bank and the Agricultural Bureau of N.S.W. as usual. The number of entries, 120 as against 180 in the previous year, reflected two things—the existence of hard-core supporters and the drought.

Quality of cattle presented for judgings was well up to the standard of previous years. The judgings provided as usual splendid extension service occasions, through associated Field Days.

Show Exhibits.—The Department's entries at the Sydney Royal Show comprised four Angus bulls from Trangie Agricultural Research Station and three Poll Shorthorn bulls from Wagga Agricultural College. One second prize was gained by an Angus bull and a third prize by a Poll Shorthorn bull. One Angus bull was sold for $900 and another for $600. Also, a Poll Shorthorn bull was sold for $600.

Three Poll Hereford steers from Hawkesbury Agricultural College were exhibited at the 1966 R.A.S. Fat Stock and Carcass Show and Sales. They gained the award of Champion Pen of Three Steers and were similarly successful on the hook. The steers were from a demonstation-group prepared for student instruction at the college.

The Department's Arab horse exhibits from Wagga and Hawkesbury Agricultural Colleges were again outstanding. They gained one Reserve Championship, two first prizes, four second prizes and two third prizes. Ten Arab horses were exhibited.

POULTRY SECTION

Industry Trends.—Despite the drought, production has slightly increased. Returns to producers have increased by about 5c per dozen.

The stock-tax of 2.8c per bird per fortnight has led to more equitable distribution of overproduction losses, and the CEMA plan has enabled more secure orderly marketing.

The trend towards larger laying-farms continued. Use of laying cages is prominent. The industry is becoming more aware of the need to reduce labour costs and to use automatic equipment. The first commercial, fully automatic laying-cage plant in New South Wales is at present being built.

A current problem is disposal of cull hens at economic prices. Prices have been depressed to 14 cents per lb liveweight by competition from meat chickens. Disposal of large numbers of culls under the all-in-allout system of production has been difficult.

Meat chicken production continued to expand, although the rate of expansion has decreased a little. Demand has been good, although the Newcastle disease incident has caused a fall which, with other factors, has left a slight surplus of production in some areas.

The trend towards earlier slaughter of meat chickens continued. Most birds are now processed at nine weeks of age. This continuing trend will permit increased numbers of birds to be produced per farm, and will help to compensate for the general decreased return per bird.

Feed prices have been high, through drought effect on availability of feedstuffs—especially protein supplement.

Extension Service Statistics.—The following figures summarize the extension activities of the poultry section this year:

Farms and hatcheries visited	732
Field days and demonstrations	8
Visits to Government institutions	37
Meetings attended	14
Press articles	24
Radio broadcasts	18
Lectures and symposia	17
Schools for farmers	2

The periodical *Poultry Notes* was maintained on a quarterly basis. It was sent to all sections of the industry. The contents were used widely in newspapers affecting the Australian poultry industry.

14th Annual Turkey Raisers' School.—This was conducted at Wagga Agricultural College as usual. It was well attended by farmers, including visitors from most other States.

Annual Poultry Farmers' Field Day at H.A.C.—This drew a crowd of over 1,000. The day, a major event for the industry, provided a useful meeting place for all facets of the industry. The poultry section's staff established an information centre there. Another feature was a new equipment award. This drew a lot of interest. The award's object is to encourage development of improved equipment for the industry.

Random Sample Test.—Random sample tests were conducted on layers, meat chickens and turkeys.

Several improvements were made in the rules for the random sample tests. The improvements are mainly in methods of sampling to ensure the testing of a truly representative sample of the types of stock offered for commercial sale.

Industry support for these tests is good. The farmers in general acknowledge their value.

APICULTURE SECTION

The Production Season.—This was one of the most difficult ever seasons for beekeepers. The drought conditions in the important inland honey-producing centres adversely affected tree-flowering and nectar-secretion. Pollen supplies were drastically affected. Maintaining hive-numbers was a formidable task.

Apiarists moved their hives long distances in the search for better conditions. Thousands of hives were migrated to Victoria, South Australia and Queensland. Moderate production was recorded on the far north coast, and in the south-west along major rivers.

Markets.—Honey prices remained lower than one would expect. This was because of movement of honey into N.S.W. from other States where the season was better, and the comparatively lower prices ruling overseas. Much of the honey that normally would be exported overseas from other States was placed on the local market.

Bee Diseases.—Incidence of disease was exceptionally light. Very few hives were infected with American Foul Brood Disease (*Bacillus larvae*). Prompt action by Departmental officers effectively suppressed it.

Selected Queen Bees for the Industry.—A record number of specially-selected queen bees was made available to apiarists from Hawkesbury Agricultural College.

The bee-breeding section of the Hawkesbury Agricultural College apiary was expanded to meet increased demands from the industry for special breeding stock.

A grant of $2,900 from the Australian Honey Board enabled purchase of a 30-cwt motor vehicle. Improved mobility of the apiary, enabling utilization of better supplies of pollen and nectar, has been vital for production of quality queen bees.

Importation of Bees.—Importation of queen bees was mainly from North America. Increased numbers were received from Canada. The Canadian queen-breeder, Everett Hastings, visited Australia to supervise a co-operative bee-breeding programme.

DIVISION OF DAIRYING

General

Mr D. W. Crowfoot, Chief, Division of Dairying commenced in May, 1966, a four months' overseas visit, to attend the International Dairy Congress in Munich and to study production, processing, manufacturing and marketing methods of milk and milk products in U.S.A., United Kingdom and Europe.

ACTIVITIES SUMMARY

The Division's activities have mainly been concerned with supervision of milk and cream production on farms, and treatment and processing of milk and milk products in dairy produce factories, in accordance with requirements of the Dairies Supervision Act, Dairy Industry Act, Pure Food Act, and Factories and Shops Act.

Satisfactory control has been maintained over flavour, chemical and biological qualities of dairy products manufactured. Some of the related technological problems have been investigated.

The Herd Production Improvement Scheme continued, quality surveys and farm projects to aid quality control were conducted, research projects were maintained, and some new projects were initiated towards dairying industry improvements.

Twenty-nine dairy officers engaged in field work aggregated 5,829 farm visits and spent 7,532 hours in factories.

THE PRODUCTION YEAR

Rainfall in most dairying areas showed an improvement by comparison with 1964–65, especially in the coastal sector. Production of milk was higher by comparison with that year, as shown in the following tabulation:

	1964-65	1965-66	Increase/Decrease
Milk	297,878,000 gal	307,015,000 gal	9,137,000 gal
Butter	29,945 tons	32,992 tons	3,047 tons
Cheese	4,129 tons	4,060 tons	69 tons

Regulatory Services

SOME STATISTICS OF THESE SERVICES

Dairy Farm Registrations.—Drought conditions and low incomes have further reduced the number of registered dairies in New South Wales. The total in 1965–66 was 12,542; 134 below the 1964–65 total.

Factory Registrations Increased.—The number of registered factories for dairy manufacture increased by two, to 67, in 1965–66. One new factory was registered for cheese manufacture and one for cheese processing. No registration was cancelled. But a Cootamundra factory manufacturing butter was totally destroyed by fire and the firm has stated that it does not intend to rebuild for that purpose.

Registrations Varied for New Products.—Four applications for Variation of Registration of Dairy Produce Factories were submitted to the Advisory Committee constituted under the Dairy Industry Act. One was for Dried Milk and three for Cheese manufacture. These were approved subject to specified conditions.

Factory Prosecution.—One factory was prosecuted, for unclean premises.

Dairy Produce Store Registrations Increased.—The number of registered Dairy Produce Stores increased to 121; 41 more than in 1964–65. Forty-three registration certificates were issued. Two were cancelled.

Margarine Manufacturing Licences.—With the Minister's approval, five licences were issued for manufacture of table margarine and seven for manufacture of cooking margarine for home consumption. Six permits were issued for manufacture of table margarine for export beyond the Commonwealth of Australia.

Issue of one Table Margarine licence has been withheld, pending final decision in a court action against one manufacturer who has continued to manufacture in excess of quota.

DAIRIES SUPERVISION ACT

General supervision of dairies registered under the Dairies Supervision Act as administered by local authorities has in many cases been found to be unsatisfactory. Help has been given by officers of this Division. When asked they have made joint inspections of dairy premises and given technical advice as required.

Plans of dairy premises, feed stalls, bull pens and calf pens have been revised by the Division. These are in process for publication.

DAIRY INDUSTRY ACT

District and head office staff gave as much time as possible to general supervision of activities of dairy produce factories, to safeguard suppliers' interests, and to ensure a high standard of hygiene and efficiency during dairy products treatment and manufacture.

Automation of manufacturing methods continues to develop. Also, most of the factory equipment is now made of stainless steel.

The marked increase in registrations of dairy produce stores, 41 more in 1965–66, has been a result of investigations of wholesale produce stores, and increase in cheese imports.

PURE FOOD ACT

Warning letters were forwarded to dairy farmers whose dairy premises were found to be in unhygienic condition and the local authority was forwarded a copy of the letter. One prosecution was necessary. A manager of a Cheese Factory was prosecuted for unclean premises.

FACTORIES AND SHOPS ACT

Most dairy produce factories were jointly inspected, by an inspector of Department of Labour and Industry and a District dairy officer. This was to ensure that all machinery is adequately guarded to prevent possible injury to factory personnel.

Dairy Science Schools

Eighteen Dairy Science Schools were held, throughout the dairy industry areas, to instruct and examine factory operatives and dairy technology students for qualification under the Dairy Industry Act.

There were 13 Milk Grading, three Milk and Cream Testing and Cream Grading, and two Milk and Cream Testing Schools.

Examination	Applications Received	Certificates of Competency issued
Milk grading	136	98
Cream Grading	52	27
Milk Testing	69	48
Cream Testing	70	48
Butter Making	24	19
Cheese Making	18	15
	369	255

Dairy Technology Refresher Schools

A Dairy Technology School was held at Taree for all District dairy officers in the areas extending from Mid Coast and Hunter Region to the Queensland Border. The Milk Board's local supervisors, and factory representatives, were also invited.

This type of school will be continued. It has proved to be excellent in bringing officers up to date in manufacture of new dairy products, in introducing new equipment and machinery, dairy research findings, and new methods.

A Refresher School held for dairy factory operatives at the Dairy Technology School, Hawkesbury Agricultural College concentrated on the conduct of routine factory-laboratory tests. Biological and chemical tests were conducted, to assist factory application of laboratory methods and procedures.

Grading and Quality of Dairy Products

BUTTER

Grading Services.—The Dairy Products grading staff made regular examination of butter (and cheese) manufactured by N.S.W. factories and received at Sydney, Newcastle, Wollongong and Canberra for distribution and storage prior to sale on the local market. Butter stored at Casino and Wagga was examined there before being cold-stored locally.

Details of the grading were supplied to distributing agents, factory managers and District dairy officers. The information was the basis of quality-control and extension work by the Division's field officers.

Statistics from the grading are the basis also for Order of Merit awards by the Department of Agriculture and the continuous Grading Competition of the N.S.W. Royal Agricultural Society. Sixteen dairy produce factories qualified for the Order of Merit Certificate.

The continued drought conditions in N.S.W. led to import of large quantities of butter and cheese from other States. At the request of the selling agents, quality was checked before distribution.

The total of boxes of butter from interstate and intrastate stores examined by the grading staff approached 1,400,000, and about 2,500 samples of cheese were examined. Powdered milk, butter oil, margarine and other products also were examined, on request by manufacturers and distributors.

Services as Judges.—The grading officers were also judges in the Dairy Produce Sections of the Sydney Royal Show, Newcastle Show, North Coast National and other country Shows, and in competitions sponsored by the N.S.W. Division of the Australian Institute of Dairy Factory Managers.

Butter Quality-control Surveys.—Samples were taken regularly and forwarded to Division of Science Services for biological examination. The results were forwarded to District dairy officers and factory managers. Analyses for moisture and salt content were done regularly, and the results of these too were forwarded to District dairy officers and factory managers.

Retail-butter surveys in the Sydney metropolitan area and country districts were done to determine the quality of butter at consumer level. Samples were subjected to sensory grading and biological and chemical analyses. Following the surveys, the outcome were discussed with distributors and manufacturers with a view to checking detected faults.

Special Quality-Investigations.—Some special investigations into quality defects were done at various factories. The Biology and Chemistry Branches of Division of Science Services co-operated with Division of Dairying in appropriate cases.

Surface-deterioration Trials.—Experimental work was done on surface-deterioration of print butter and the use of various types of wrapping material. Results of the experiments were supplied to the industry.

Continuous Butter-making Machine on Trial.—Grading staff co-operated with the factory management and Lismore District dairy officer in a check on the efficiency of a continuous butter-making machine on trial at the Norco Lismore factory.

CHEESE

Cheddar Cheese.—Quality was maintained. Of the total of "marks" submitted for grading, 80 per cent were first grade. Some 64 per cent of the cheese so graded was from two factories. These continued to submit a cheese from each vat manufactured. Knowing regularly how their cheese was grading they could amend their manufacture accordingly.

Biological, Cheese Survey.—This survey was recommended in November, 1965; with 16 factories regularly forwarding samples and the remaining six at irregular intervals due in part to insufficient milk for cheese-making.

Cottage Cheese.—Manufacture continued to expand. There are now eight registered factories making both uncreamed and American-style creamed cottage cheese.

Fancy Cheeses.—Production has not notably increased, due to the effect of drought on supplies of milk. Small quantities of Gouda, Roman, Mozzarella, and Ricotta, and token quantities of blue-veined cheese were made.

Special Investigations into Cheese Quality.—Special investigations were made in three factories. These revealed that faulty starter-propagation was the main trouble, together with shortage of skilled operators.

Lactic-starter Survey.—Current methods of starter-propagation in factories were surveyed.

New Legislation Affecting Cheese Manufactures.—Regulations under the Pure Food Act, as amended in late 1965, introduced compulsory pasteurization of milk and milk products for cheese-making and set minimum standards for 89 varieties of cheese. This gave rise to a survey of present heat-treatment methods, so that factories could be advised how best to meet the new Regulations.

OTHER MILK PRODUCTS

Other Cultured Milk-Products.—Manufacture of yoghurt, buttermilk, and sour cream continued to expand. Ten factories are now making these lines.

Casein Manufacture.—Interest in manufacture of casein has been expressed by two factories. Due to milk shortages in the areas, no finality has been reached.

Ice Cream Production.—This has increased. It is absorbing much of the skim milk which was available for drying and cottage-cheese manufacture.

The Milk Bulk-collection Trend

The trend towards bulk milk collection continued. It has caused demand for qualified tanker-driver/milk graders. This has necessitated special examinations and resulted in issue of 28 Tanker-Driver Certificates after milk-grader examinations.

Twelve factories have introduced bulk milk-collection and more factories are looking closely into it.

Dairy Industry Extension Services Grant Effect

Funds from the Commonwealth Dairy Industry Extension Services Grant have been of major assistance in the following ways, amongst others:

- Maintaining the Herd Production Improvement Scheme;
- Recording 1,000 or more cows for Solids-Not-Fat, in a special project;
- Continuation of the Milking Machine Efficiency Survey;
- Continuation of the Sire Survey (resulted in information having been collected re 6,665 bulls used over a three-year period);
- Conduct of dairy farm demonstration projects;
- Continuation of testing of Milking Machine Air-flow Meters.

Some of the grant was used this year also to construct a model cow, to demonstrate the circulatory system and how milk is secreted; and to construct a pilot milking-machine plant further to demonstrate the milking process. These models have had very satisfying use on television and at shows and field days.

The Milking Machine Efficiency Survey

The Survey, conducted over the past ten years, has revealed that about 80 per cent of the examined milking machines need considerable attention to make them efficient. Some 1,500 machines have been tested during 1965–66. Their condition has been reported to the farmer for appropriate action. Numerous glaring examples of mechanical defects have been used in extension service, through the press and at field days.

The survey should eventually prove to have been a valuable contribution to control of mastitis.

Dairy Research Activities

Dairy research conducted by this Division, at Hawkesbury Agricultural College, is reported in the College section of this Report of the Department (see page 127). The scope of the research is indicated by the following headings:

PRODUCTS MANUFACTURE

Rapid methods for determining the composition of milk.

Influence of seasonal variations in the compositional quality of skim milk, on physical and chemical qualities of spray-dried skim-milk powder.

Problems associated with the manufacture and keeping qualities of processed cheese.

Infra-Red Milk-Analyser (IRMA) Trials.

DAIRY HUSBANDRY

Efficiency of dairy detergents and sanitizers.

Milking machines and mastitis.

Microflora of the milking machine.

Milking machine efficiency.

This Department is now the recognized Dairy Detergent Testing Station for Australia, and is also testing detergents supplied by the New Zealand Department of Agriculture.

Herd Production Improvement Schemes

HERD RECORDING

Staff.—As in 1964–65, the herd recording staff totalled 110, comprising 91 herd recorders, 11 relief recorders and 8 herd organizers. There is approval to increase the number of herd organizers to 10 to restore a ratio of 1 organizer to 9 recorders in the field. The 2 extra positions have yet to be filled.

Herd Recorders' School.—A four-day school was held in May, 1966, at Hawkesbury Agricultural College for herd recorders. This is the fourth since 1962.

Needed Expansion of Recording Scheme.—Active demands exist, in the form of a backlog of farmers waiting to join a unit, for nine to ten more recording units to record about 10,000 more cows.

Official Recording (Registered Dairy Cattle).—In the twelve months to 30th June, 1965, the numbers of herds recorded was 261; 6,878 cows completed lactations of 6 months or over, and other cows exceeded the standard in a lesser period. Butterfat production average was 328 lb and milk 7,988 lb; slightly below the 1963–64 figures of 335 lb fat and 8,161 lb milk, but meritorious in light of the fact that the State's dairying districts experienced one of the worst droughts on record.

Group Herd Recording (Grade and Pure-bred Cattle).—In the twelve months to 30th June, 1965, the total of cows recorded was 87,241; 70,906 cows completed lactations of 6 to 10 months, for an average of 5,461 lb milk, 4.23 per cent test and 230 lb butterfat. The butterfat figure is 8 lb below the average for 1963–64, but satisfactory in view of the drought conditions.

Some 9,609 cows completed short lactations of from 1 to 5 months, and these average 2,262 lb milk, 4.07 per cent test, for 92 lb butterfat.

The all-in average for 80,515 cows completing lactations of from 1 to 10 months was 5,079 milk, 4.22 per cent test and 214 lb butterfat.

Part-lactation cows amounted to 6,726.

Highest district averages for cows completing 6–10 months lactations were:

Orange District—839 cows, 8,049 lb milk, 3.7 per cent test, 298 lb fat;

Deniliquin District—8,330 cows, 6,565 lb milk, 4.53 per cent test, 297 lb fat;

Nowra District—8,987 cows, 6,852 lb milk, 3.8 per cent test, 261 lb fat.

RULE CHANGES FOR OFFICIAL AND GROUP HERD RECORDING SCHEMES

On 21st September, 1965, the Registered Dairy Cattle Association of N.S.W. formally suggested to the Department "that all Official Herd Recording throughout Australia should be on a uniform basis, and the same to apply to Sire Survey Ratings".

At this time the Department was conducting an Australia-wide survey of Official Herd Recording Rules, in accordance with a decision made in November, 1964, by the Australian Animal Production Committee's Technical Sub-Committee on Dairy Cattle Production. This survey showed that some of the New South Wales rules needed revision, towards uniformity with other States.

A statement of suggested rule changes was circulated to all dairy cattle breed societies, and the Department's Principal Dairy Officer (Herd Improvement) attended meetings of individual breed societies to explain the proposals to members.

In due course, at a meeting of the Registered Dairy Cattle Association (comprising the various individual breed societies) in April, 1966, and by subsequent Departmental confirmation, the necessary changes to the Rules of the Official Herd Recording Scheme were approved to commence from 1st July, 1966. They are substantial.

Government Herds

Production.—All except the Yanco Guernsey herd were affected by drought. The most seriously affected were Grafton A.I.S. and Jersey herds and the Wagga Jersey herd. But the Wagga herd was the only one that dropped in production, and for the first in many years the Wagga Jerseys' average for butterfat fell below 400 lb.

The Hawkesbury Friesian herd improved by 40 lb in butterfat average to be fourth from top herd in the group—for herds with 40 cows or over.

The Yanco Guernseys also improved their average, by 32 lb butterfat, to be fourth from top in the group—for herds with 20 to 39 cows.

The Polled Jersey Project herd at Grafton continued to be the lowest producing herd but is steadily improving. Its butterfat average is now only 25 lb below the A.I.S.

Actual figures for 1964–65 were: Wagga Jersey—38 cows, 7,224 lb milk, 5.1 per cent, 371 lb butterfat; Grafton Jersey—38 cows, 7,225 lb milk, 4.6 per cent, 331 lb butterfat; Grafton A.I.S.—42 cows, 8,903 lb milk, 4.0 per cent, 356 lb butterfat; Yanco Guernsey—29 cows, 8,844 lb milk, 4.8 per cent, 428 lb butterfat; Hawkesbury Friesian—46 cows, 12,350 lb milk, 3.7 per cent, 459 lb butterfat.

A Breed-Record Guernsey.—One Departmental cow established a new breed-record. This was the Guernsey cow "Wollongbar Amber 3rd". She established a new milk-record for a mature Guernsey cow—16,445 lb milk, 4.7 per cent, 766 lb butterfat in 365 days.

Competitive Exhibits.—The Departmental studs had a very successful show year, at local shows and at the Royal Easter Show.

Among the results were the winning of the Champion Jersey Bull and Junior Champion Jersey Female awards at Grafton Show, with two animals from the Grafton Research Station's polled jersey project.

At the North Coast National Show a team of A.I.S. cattle from Grafton Research Station gained a number of awards in a strong competition and also, in interbreed competition, won the W. V. Norton trophy for the Five Highest Producing Pure-breed Cows, and the Samuel Taylor trophy for Highest Producing Pure-bred Cow.

At the Royal Easter Show, a Hawkesbury Agricultural College Friesian team gained the Most Successful Exhibitor award for the sixth successive year, and other awards including Reserve Junior Champion Heifer in both Friesian and Guernsey sections and the Champion Bull award in the Guernsey section. In all, 14 Firsts, 12 Seconds, 11 Thirds and three Fourths were gained.

At Wagga Show a Jersey team from Wagga College gained many awards, including Champion Jersey Bull and Cow, and also won the interbreed classes for Best Udder—All Breeds and Supreme Champion Dairy Cow.

Sale of Stock.—Demand for bulls and females from most of the Department's studs has been higher than could be satisfied. In all, 138 pedigreed animals were sold in the twelve months.

Departmental cattle topped the special Royal Show sales and the Friesian Society Breed Sale, with Friesian heifers from Hawkesbury Agricultural College which brought $1,200 and $1,100 respectively. At the Friesian Society sale the $1,100 was a sale record. Heifers from Grafton and Yanco also sold well.

For the fifth year in succession one of the College Friesians was bought at the Royal Easter Show auction by an interstate breeder. Three have gone to Western Australia, one to Victoria and one to Tasmania. One of the early heifers that went to Western Australia was eventually Champion Friesian cow at Perth Royal Show. The bull which went to Tasmania was unbeaten in the show ring in Tasmania, and was eventually classed as the Friesian Bull of the Year by the *Livestock Bulletin*.

Bulls to Artificial Stock-breeding Centres.—A Guernsey and a Friesian bull were forwarded to Artificial Stock-breeding Centres, and a Friesian and an A.I.S. are at present under offer.

Fourteen Departmentally owned bulls are located in Artificial Stock-breeding Centres. They comprise 21 per cent of the bulls in use. The Department owns two of the three premium bulls now in use.

Artificial Insemination in Departmental Studs.—Some use has been made of artificial insemination in Departmental studs, mainly at Hawkesbury College in the Friesian breed. Young bulls have been used to some extent in other herds, mainly to assist the Milk Board's bull-proving scheme.

The Milk Board is holding good stocks of semen from the following bulls for Departmental use: *Friesian*—"Sniders Fond Hope King", "Frasea Lord Jewel", and "Trailynd Royal Beau"; *Guernsey*—"Wollongbar Vera's Royalist"; *Jersey*—"The Mounts Orange Boy" and "New England Wizards Designer (Poll)". Several hundred ampoules from "New England Wizards Designer" also were collected and deep frozen while this bull was on loan to Sydney University.

Sire Proofs.—Progeny surveys on several of the stud sires have yielded pleasingly.

Of particular interest is that for the two homozygous polled bulls at Grafton there is strong positive evidence for both milk and butterfat. "New England Wizards Designer", with a small weight of 7 has R.G.V. Milk 103 and R.G.V. Fat 108. "New England Alto's Dandy", with a weight of 8 has R.G.V. Milk 105 and R.G.V. Fat 110.

At Wagga the herd sire "Wagga Faithful Baron" with a weight of 15, shows an R.G.V. Milk 101 and R.G.V. Fat 119.

Identical Twins.—The response to the quest for identical twins has been poor. Only one set was purchased this year. Several sets inspected were considered unidentical.

Stud Animal Purchases.—Two Ayrshire heifers were purchased for student demonstration purposes at Yanco Agricultural College.

A stud Guernsey bull, "Junction Tess Royalist", was purchased (at Mr L. Bentley's reducing sale) for $798, for Yanco Agricultural College. He is by the top-proven Departmentally-bred bull "Wollongbar Vera's Royalist" and from "Junction Lustre Tess" the Champion and Best Uddered Cow at the Melbourne and Sydney Royal Shows and producer of over 600 lb butterfat. "Junction Lustre Tess's" dam "Junction Miss Tess" was also a 600 lb butterfat producer, and was Champion Cow at Melbourne, Sydney and Adelaide Royal Shows.

Herd Activities.—The Departmental herds' services to dairy industry or research included this year the following:

Six pairs of matched heifers for research trials at Wollongbar;

Mature bulls in batches of two to University of Sydney for semen collection studies;

Twenty calves for the DAN 12 Parasite Survey project at Grafton Research Station;

Continuance of Solids-Not-Fat monthly recording in all herds as part of the Dairy Grant project No. 8A (now at a stage where consideration is given to the S.N.F. levels of dams and half-sisters of Departmental bulls selected for use in Artificial Stock-breeding Centres);

Comparisons at Hawkesbury College and Wagga College and Grafton Research Station of a calf-starter and meal (from Hunter Valley Co-operative Dairy Co. Ltd.) with the normal Departmentally-recommended method of rearing;

Continuance of the Growth and Development Survey;

Continued sire-assessments on as many young bulls as possible (these are selected from proven sires and on measuring up to requirements will be offered to the Milk Board for Artificial Stock-breeding work);

The *Polled Jersey Project*. (Production and type in this herd are improving steadily. A new phase of the breeding activities is beginning, with more intense use of the two top proven homozygous bulls. The project is now concentrating on getting a maximum of polled females, particularly homozygous polled females, so that culling for low production and undesirable features can be speeded.)

Solids-Not-Fat Recording

TWO EXPERIMENTAL SOLIDS-NOT-FAT RECORDING UNITS

These, at Parramatta and at Nowra, continued to operate satisfactorily.

Information was collected from 29 commercial herds (over 1,000 cows). Also from the five Departmental Studs (Guernseys at Yanco College, Jerseys at Wagga College, Friesians at Hawkesbury College and A.I.S. and Polled Jerseys at Grafton Research Station).

Collection of information from the two Units commenced in April, 1961, and, to 30th June, 1966, together with the Departmental Studs, will give five complete years of information on about 5,500 completed lactations.

Three years ago a preliminary survey of the material collected to that time was made. That survey indicated factors affecting Solids-Not-Fat that were similar to those reported in overseas literature.

A preliminary, computer-run of the now available information has shown promise of very valuable information on the factors that affect Solids-Not-Fat content in N.S.W. conditions. Progress reports will be made over the next 12 months for application in extension service.

A SOLIDS-NOT-FAT RECORDING SCHEME FOR PURE-BREDS

Requests from breed societies and farmers organizations have encouraged the Division of Dairying to look into various problems involved in introduction of a Solids-Not-Fat testing scheme for dairy farmers generally. The goal would be to work it into the regular framework of the Herd Production Improvement Scheme, as distinct from the current two experimental units.

Close examination has shown that with bi-monthly recording and some rule changes in Official Recording—to provide a system of "check tests" instead of the "strip outs"—it would be practicable to introduce a small-scale scheme for S.N.F. Recording for pure-bred dairy cattle.

As a result, a circular has been issued to all stud breeders in the Nowra Dairying District. The Nowra District was chosen because it contains a third of the Official Herds under Record and provided a chance for a "pilot-scheme" to be tried out. The circular explained the scheme and asked the farmers to advise the Nowra District dairy officer if interested.

At 30th June, 1966, it was apparent that between 40 and 50 pure-breeders would participate in the scheme, to commence on 1st July, 1966.

Sire Survey

RATINGS BY RELATIVE GENETIC VALUE

Consolidated information for the three-year period 1962–65, on 6,665 bulls, became available this year by continued use of the computer. These bulls have been rated by Relative Genetic Value (R.G.V.). Basically, this method compares the bull's daughters with all other cows of the same age, milking in the same herd, in the same year. It eliminates most of the effects of differing management and of seasonal variation.

To assist the essential correct interpretation of figures the survey information is in three sections—Official, Intermediate, and Preliminary—determined by the "weight" given to each bull's R.G.V. In any one herd, less importance could be attached to the result if, say, one daughter were compared with 10 contemporaries, or 10 daughters with one contemporary, than if five daughters were compared with five contemporaries.

This is much more important when the figures of daughters in different herds are being added together. To overcome this problem, the importance of the figures in each herd is estimated by a statistical device. This is added to give the final "weight" or "estimate of reliability" of the survey. The method cannot be used in herds where the only cows in a particular age group are the bull's daughters, because there are no contemporaries for comparison. Recourse to "expectancy" or some other method is then necessary.

In using the R.G.V. for each bull, the "weight" indicates reliability of the survey. In the Preliminary section, additional information could change the estimate considerably, but the R.G.V. does indicate whether or not the bull will lift production.

The R.G.V.'s have been processed as soon as possible after 30th June each year. But for the next year (1966–67) there are arrangements to process as soon as possible after 31st December the information available for the six months from 1st July, 1966. This information will be made available to the Artificial Stock-breeding Centre so that the Centre may give to farmers the most up-to-date information in time to plan their early 1967 spring matings.

Processing of the data so speedily and for so many bulls was impracticable before the computer was applied to it.

PUBLICATION OF R.G.V. RESULTS

In the July-August, 1965, issue of *Dairy Topics* the R.G.V.'s for 400 bulls were published. Such publication will continue in 1966–67. Meantime, information on bulls is available on request.

Also, as mentioned in an earlier paragraph, a survey of official Herd Recording Rules throughout Australia has been carried out for the Australian Animal Production Committee's Technical Sub-Committee on Dairy Cattle Production—towards uniformity of interstate schemes of Herd Recording. Arising from this survey a comprehensive report was forwarded to the Secretary of the Animal Production Committee in September, 1965.

Further summaries were subsequently forwarded, in September, 1965, and May, 1966. The latter has been circulated by the Secretary to all delegates of the Technical Sub-Committee on Dairy Cattle Production, for discussion at a June, 1966, meeting.

DIVISION OF SCIENCE SERVICES

Biology Branch—Plant Pathology Section

GENERAL AND STAFF ITEMS

Project in India.—Dr Lilian Fraser visited India to ascertain the cause of the dieback disease of citrus which is threatening citrus culture there. The disease had come to be accepted as due to tristeza virus, with zinc deficiency contributing. However, Dr Fraser's observations resulted in diagnosis of the disease as greening, a disease first described in 1963 in South Africa.

It is now suspected that a mild form of greening is present in eastern Australia in the Ellendale variety of mandarin. It may also be responsible for a hitherto undiagnosed disease of grapefruit in the Lower Murray area. Intensive surveys have been initiated. Indexing commenced in November, 1965, and will be expanded.

Wool Research Trust, Post-graduate Award.—Mr R. J Roughley has been awarded a scholarship by the Wool Research Trust Fund for post-graduate studies at Rothamsted Experiment Station, England. He will be there three years for work on symbiotic fixation of nitrogen.

Plant Pathologist to Wollongbar.—A plant pathologist has been transferred to the Agricultural Research Station, Wollongbar, to study diseases of vetches and also advise extension officers on plant diseases and disease control.

Quarantine.—Tenders have been called for erection of a quarantine glasshouse for the Federal Department of Public Health (Plants) in the Division of Science Services' grounds at Rydalmere. This will permit concentration of quarantine plants on a site where frequent inspection by plant pathologists will be possible.

U-D.A.L.S.—Reorganization of the University and Department of Agriculture Laboratory Services (U-D.A.L.S.) establishment is necessary following resignation of Professor J. M. Vincent from the Faculty of Agriculture, University of Sydney. The U-D.A.L.S. group has been responsible for outstanding improvement in quality of cultures of *Rhizobium* distributed to farmers in all States of the Commonwealth. Professor Vincent's guidance will be greatly missed. The latest contribution has been the introduction of a sterilized peat method of production of cultures. This work was done in the Biology Branch.

Colour Leaflets.—A series comprising forty-eight illustrations in colour, of selected diseases of plants, to be reproduced as Plant Disease Leaflets, has been prepared by artist Mrs Margaret Senior. The quality of the illustrations is excellent.

NEW PLANT DISEASE RECORDS

This year, sixty-one new plant diseases were recorded in New South Wales. Thirteen were new host records of *Meloidogyne* spp., the root knot nematodes.

Amongst the vegetables, two records were of particular interest. In January, 1966, onion smut (*Urocystis cepulae* Frost) was recorded from a nursery at Blayney. It was found on mature bulbs and, later, on young seedlings. Quarantine measures have been enforced to try and eradicate the disease. The other new record of interest was *Helminthosporium allii* Campanile, which was found on garlic bulbs as a sooty growth on the bulb scales. This fungus has been intercepted frequently on imported garlic bulbs.

On the north coast, a bacterial leaf-spot disease damaged a crop of the tropical legume *Glycine javanica*. On the basis of cross-inoculation tests of French beans, the bacterium has been tentatively identified as *Pseudomonas phaseolicola* (Burkh.) Dowson, the bean halo-blight organism.

A species of *Claviceps* has been found on cocksfoot and ryegrass in southern N.S.W. Its identity is being investigated. This ergot is distinct from *Claviceps purpurea* (Fr.) Tul. It has been present at times in seed samples.

Other records on field and fodder crops included the fungus *Podosporiella verticillata* O'Gara, associated with seed-rotting of additional grasses and non-grass hosts, and club root (*Plasmodiophora brassicae* Wor.) which damaged a crop of white mustard.

Two interesting fruit diseases were recorded for the first time. One was leaf and fruit spot of apple (variety Delicious) caused by *Sphaceloma* sp. The other was tan fruit rot of strawberry caused by *Hainesia* sp., in one small planting on the central coast. Each of these diseases may be more widespread in N.S.W.

On ornamental plants, a brownrot fungus (*Sclerotinia* sp.) was found rotting berries of cotoneaster. The parasitic alga *Cephaleuros virescens* Kunze was also found on some additional ornamental and native plant hosts, including camellia and port wine magnolia.

The new records of diseases included several on weeds and native plants.

THE BIOLOGY BRANCH HERBARIUM (DAR)

Almost two thousand specimens, mainly plant parasitic fungi, were added to the Herbarium this year. The majority were N.S.W. collections but some exsiccatae were received on an exchange basis from overseas institutions. The Herbarium now contains over 17,000 specimens. Several loans were made to Australian and overseas workers.

THE CHECK LIST OF PLANT DISEASES IN N.S.W.

Considerable literature on N.S.W. plant diseases, including many references dealing with first records of diseases in N.S.W., was summarized.

On this basis many original specimens of N.S.W. plant diseases were borrowed from overseas herbaria (especially the Royal Botanic Gardens Herbarium, Kew, England) and it was possible to correct or amplify some of the early records.

Results of associated systematic studies on some of the fungi have been published. Another paper is in press and others are being prepared.

Several hundred recent collections have also been examined and identified.

The check-list manuscript for various groups is still being prepared.

NEMATOLOGY COLLECTION

About 85 groups of specimens were added to the nematology collection. It now contains 292 groups. *Aphelenchoides* spp., *Ditylenchus* spp., *Meloidogyne* spp., *Radopholus similis*, *Trichodorus* spp. and *Tylenchulus semipenetrans* received most attention. They were found most frequently associated with crop losses.

Several *Aphelenchoides* spp. and *Aphelenchus avenae* were found widely. Their effect on cropping of the cultivated mushrooms is being studied.

Root-knot nematodes, *Meloidogyne* spp., were found on 24 hosts from 20 different localities. Eleven of the hosts had not previously been recorded as hosts, in New South Wales, of the particular *Meloidogyne* species.

Ditylenchus dipsaci, Radopholus similis and *Tylenchulus semipenetrans* were found associated respectively with diseased daffodil bulbs, banana roots and citrus roots.

Attempts to show by inoculation tests that *Trichodorus* is the cause of a stubby-root condition of citrus continued.

WHEAT DISEASES

Barley Yellow Dwarf Virus.—For the last two seasons there have been trials at Tamworth and Condobolin to determine whether barley yellow dwarf virus causes a significant yield loss in N.S.W. wheat crops. The trials are being repeated for a third and final season.

Last season the severe drought caused a complete failure of the Condobolin trial. The Tamworth trial was harvested. The results indicated the disease did not cause a significant yield loss.

Aphid-trapping at both sites gave valuable information on incidence of the vectors of barley yellow dwarf virus.

Flag Smut (Urocystis agropyri).—Incidence has increased significantly in northern N.S.W. over the last few seasons. In the season before last, tetrachloronitroanisole (TCNA), a new chemical seed-treatment, effectively controlled both seed- and soil-borne infections. This work was repeated at Tamworth last season. The dry conditions seriously interfered with the results.

A separate trial was set up to determine whether TCNA was phytotoxic at the rates. At rates higher than ¾ oz active TCNA per bushel there was significant yield-reduction. It is understood that chemical firms are no longer interested in the manufacture of TCNA for agricultural purposes.

OAT DISEASES

Loose Smut (Ustilago avenae).—Occurrences of what appeared to be a new race of loose smut of oats have recently been reported. It was reported as able to infect the variety Acacia, previously highly resistant.

Preliminary glasshouse tests were made on oat varieties, using the seeming new race and the standard strain of loose smut. The results, though inconclusive as yet, strongly indicated a new race. It seems possible that there may be at least three distinct races of loose smut in New South Wales. These indications if correct will be important in plant breeding.

A field trial has now been set up at Rydalmere to enable determination of the oat loose-smut race-position in N.S.W.

MAIZE DISEASES

Seed Treatment of Maize.—Results are available from an experiment to determine the effect various common fungicidal seed treatments have on germination of maize seed stored for prolonged periods after treatment. The chemicals used were chloranil (96 per cent tetrachloroparabenzoquinone), ceresan (2.3 per cent phenyl mercury acetate-ethoxyethyl mercury silicate 0.4 per cent) and panogen (2.2 per cent methyl mercury dicyandiamide), and the two hybrid maize varieties were GH128, a late season variety, and GM211, a mid-season variety. After treatment the seed was stored either at room temperature or in a constant-temperature room running at 18°C. Samples were taken each month and germinated in sterile soil and in paper-towel "ragdolls". The germination figures for each treatment were compared with those for untreated control seeds.

The experiment ran for twelve months and showed that seed viability is unaffected by any of these chemical seed treatments or by any of the other factors introduced.

RICE DISEASES

Downy Mildew (Phytophthora macrospora).—Stunting of Caloro rice in a Coleambally Irrigation Area crop was identified as downy mildew. It was the first record since 1934, but probably the disease has been present all this time. Two presumably highly-susceptible rice breeding-lines at Yanco Agricultural College and Research Station were also wiped out by downy mildew this year but surrounding lines showed no symptoms.

Seed Rot and Damping Off.—This was investigated. A number of Pythiaceous fungi, *Rhizoctonia* spp., and other possible pathogens were isolated. *Achlya* spp., important pathogens in other parts of the world, were not recorded. The work is continuing.

DISEASES OF FODDER AND PASTURE PLANTS

Vetch Root Rot (a Phycomycete) was not severe, but as usual occurred commonly on the Lismore red basaltic soils. Glasshouse experiments have demonstrated that relatively high soil temperature and high inoculum density favour severity of the disease.

Glasshouses and field assessments were continued on a range of *Vicia* spp. Notable resistance to root rot was found in several lines of *Vicia atropurpurea. Lathyrus sativus* appears to be susceptible. Other legumes are being investigated.

Vetch Decline (cause unproven).—It was extremely rare this autumn. The disease, thought at first to be caused by a virus, may be bacterial. But pathogenicity tests with the bacteria so far isolated have proved negative.

Vetch Rust (Uromyces viciae-fabae). This became prevalent in mature stands in winter and early spring of 1965. The effect on yield was only slight.

Clover Root Rot.—In the autumn there was poor establishment and growth of clover on the southern tablelands. Inspections around Goulburn did not reveal any extensive disease problem. The CSIRO at Canberra are continuing an investigation into incidence, and possible control by fungicides without affecting the efficiency of nodulation by the *Rhizobium* with which the seed is normally pelleted.

Lucerne Witches' Broom.—Until recently it was thought that witches' broom of lucerne was only caused by tomato big bud virus transmitted by leaf hoppers. But in Victoria similar symptoms result from attack by eriophyid mite. This year, in N.S.W., mites were observed in witches' broom specimens at Trangie and Narrabri. If spraying will control the mite, lucerne yields may increase markedly. The Entomology Branch has this under notice.

Glycine Diseases.—A major outbreak of bacterial blight (*Pseudomonas* sp.) occurred in autumn. The disease had been noted for several seasons, but had caused little concern. This season it appeared early in February after a series of severe hailstorms. Stunting was noted in February but subsequent growth was virtually free of disease. However, in May the new growth was severely yellowed and stunted. Yield reduction of new growth was expected to be heavy.

There is considerable concern about the seed crops. The bacteria are seed-borne.

TURF DISEASES

Spring Dead-spot of Couch Grass.—This continued to be the most serious disease of couch grass (*Cynodon dactylon*) turf in N.S.W. Two fungi have been found capable of causing this root rot disease here.

A statistically designed trial was set up this year to find one or more fungicides to control this disease. Five fungicides recommended for use on turf are being investigated. So far, two of them are very promising.

Couch Grass Seedling Blight (Helminthosporium rostratum). —The fungus was shown to cause a seed-borne serious blight of couch grass seedlings, whereas it was previously known as a leaf spot pathogen. Attempts to control the seedling blight by treating infected seeds with various fungicides have not succeeded.

AERATED STEAM TREATMENT OF GRAMINACEOUS SEED

With improvement of equipment, the accuracy of this method of treatment has increased. Various graminaceous seeds of known moisture content were treated for different times at fixed temperatures. The relationship between moisture content and maximum times and temperatures for treatment will be valuable in assessing the likelihood of controlling various seed-borne diseases, including loose smut of wheat. These experiments are being continued.

DISEASES OF VEGETABLE CROPS

Potato Seed Certification.—Data compiled by Division of Plant Industry showed that no tableland crop was rejected from certification through excess content of leaf roll or other diseases. On the northern tablelands some roguing of blackleg-affected plants was needed but incidence of leaf roll was below certification-tolerance.

The Biology Branch continued to co-operate with Division of Plant Industry in checking, for virus diseases, the foundation stocks of elite seed being built up at the Agricultural Research Station, Orange.

Potato Late Blight (Phytophthora infestans).—This was not seen in N.S.W. crops this year. The absence of inoculum severely limited the co-operative work with Division of Plant Industry in testing advanced seedlings derived from late-blight immune parents. The one seedling assessed, No. 2345 (Adina x 11–79 x Cherokee) proved susceptible to the "O" race of the fungus.

Potato Common Scab (Streptomyces scabies).—Work continued in co-operation with Division of Plant Industry for development of scab-resistant varieties. The dry season on the central tablelands again favoured heavy scab-attack on susceptible varieties. Scab reaction of a number of varieties and seedlings grown in the early and late maturity trials at the Agricultural Research Station, Orange, was assessed.

The scab-reaction rating for each seedling and for the susceptible control varieties was calculated on the severity of lesions. A scab index number (maximum 4) was calculated for each variety or seedling. Results were: S2902 (Delus x Redskin), 0.61; S2904 (B595–76 x Smooth Rural x Katahdin), 0.69; S2889 (B595–76 x Adina), 0.75; S2897 (Redskin—natural pollination), 0.96; S2885 (Awaba x 336–123), 1.08; S2887 (Crana x Redskin), 1.14; Norland (a scab-resistant variety ex U.S.A.), 1.34; S2881 (Awaba x 336–123), 1.83; Sebago (susceptible control), 2.89; and Excel (susceptible control), 3.30.

Potato Rugose Mosaic (*Potato Virus X and Potato Virus Y*).—Tests were continued, to determine the field reaction of a number of advanced Departmental seedlings to aphid infection by Potato Virus Y (PVY). The results showed that three of these seedlings developed a leaf drop streak-reaction to PVY. These were S2890 (Sequoia x Cortland), S2897 (Redskin—natural pollination) and S2902 (Delus Redskin).

At the request of Division of Plant Industry the reaction of two growers' selections to aphid-borne PVY was tested. Each of these two selections, "Miller Ebor No. 1" and "Johnson, Deerville No. 2", gave mixed reactions. Some of the plants were highly susceptible to field infection by PVY, and developed mosaic symptoms. Others acted as symptomless carriers. The PVY-tolerance of the two selections precludes their eligibility for certification in N.S.W.

Tomato Fusarium Wilt (Fusarium oxysporum f. lycopersici) and *Verticillium Wilt* (Verticillium dahliae).—Cultures of these fungi were supplied to tomato breeders at Hawkesbury Agricultural College and Yanco Agricultural College and Research Station for use in the breeding of resistant varieties.

Some tests were done at Rydalmere to determine the reaction of imported varieties and locally bred lines to local isolates of one or both of these pathogens.

The U.S. varieties Hotset, Uniset, Step 372 and Step 397 were found to be resistant to the *Fusarium* wilt. Uniset was found to be susceptible to the *Verticillium* wilt.

Five lines from the cross *Lycopersicon pimpinellifolium* A160 x Rouge de Marmande, ex Hawkesbury Agricultural College, were susceptible to the *Verticillium* wilt.

Eight advanced lines from Yanco Agricultural Research Station were highly resistant to the *Fusarium* wilt and three others were moderately resistant.

Seed of a *Verticillium*-resistant (VR) Marmande was obtained from the Summerland Research Station, B.C., Canada. The variety's reaction to local isolates of *V. dahliae* was assessed in a glasshouse test at Rydalmere. Plants of the VR Marmande showed variable resistance to the *Verticillium* wilt, compared to the susceptible Rouge de Marmande. Some plants of VR Marmande showed high resistance. Seed of these has been saved for further work.

Tomato Greyleaf Spot (Stemphylium sp.).—It was first recorded in N.S.W. at Duranbah in 1963. The fungus on that occasion was identified as *Stemphylium solani*. This year, the disease was found in tomato crops in the Sydney metropolitan area, the Hunter area and on the lower north coast. Exact identities of *Stemphylium* spp. associated with greyleaf spot of tomato in N.S.W. are being determined

Disease Control Results with Misting Machines.—Biometrical analysis of results from the Horticultural Research Station trial in 1965 showed that weekly application of copper oxychloride by high volume spray (2½ lb/100 gallons) or by misting machine (4 oz/2 gallons) gave significantly greater control of early-blight fruit-rot in trellised tomatoes, compared to plants not receiving weekly fungicide treatment. In the dry autumn conditions incidence of early-blight fruit-rot was not heavy.

This work, co-operative with the Chemistry Branch and Entomology Branch, was commenced in 1959. It has yielded an understanding of (*a*) the types of misting machine most adaptable for application of fungicides and insecticides to tomatoes, (*b*) the rates of pesticides which can be applied by misting machine, and (*c*) the most efficient method of application of pesticides by misting machine. The work has ended.

Asparagus Decline and Replant Problem.—Pathology work on the asparagus decline and replant problem at Gundagai continued.

This season, the first full spear cut was made from a block of the *Fusarium*-tolerant strain of the Mary Washington variety planted in old asparagus ground in 1963. It was compared with a full spear cut from the 500W *Fusarium*-susceptible strain planted in old asparagus ground in 1962. The *Fusarium*-tolerant strain yielded 4,077 lb of spears per acre, with 6.3 per cent culls. The 500W strain yielded 4,146 lb per acre, with 8.0 per cent culls. This performance by the *Fusarium*-tolerant strain is highly promising. The canning quality was equal to that of the 500W strain.

Selection of suitable agronomic plants in a seedling block of the *Fusarium*-tolerant strain was completed and over 30 lb of their seed was harvested. This seed, with more from the plants, will be used to plant a five-acre block—to supply annually enough seed to replant at least 100 acres on old asparagus ground.

Plants from rows of 500W asparagus planted annually since 1962 on old asparagus ground were examined. This ground has been either fallow since that time or been planted to vegetables or laid down to pasture. Generally, plants from 1962 and 1963 plantings were showing more root and crown rot than were plants from 1964 and 1965 plantings. The type of cropping since the experiment commenced did not appear to be affecting symptom-severity. Isolations from affected roots and crowns showed more *Fusarium oxysporum* and *Fusarium moniliforme* var. *subglutinans* than *Fusarium moniliforme*.

Bean Seed Certification Scheme.—Data compiled by Division of Plant Industry indicated that no crop was rejected through disease. Of eight crops, comprising 55 acres, only one crop was not certified. This one was because of late application. More certified seed is expected this season than in the previous two years.

Stringless French Beans Root-rot Complex.—This problem, outlined in previous reports, again caused considerable losses in western and southwestern stringless bean crops grown for processing. The disease was also in the Bathurst and Windsor districts and again associated with unusually hot dry weather.

Four resistant varieties have recently been released by Division of Plant Industry. These will be the only varieties grown in one inland area where the disease has been serious. In other areas the susceptible Pearlgreen, Tendercrop and Improved Tendergreen, and a resistant Tendergreen line will continue to be grown until a resistant variety with required processing quality has been proven.

French-Bean Rust (Uromyces appendiculatus).—Work outlined in last year's report showed Redlands Greenleaf and Redlands Pioneer to be resistant to natural rust infection in the field at Rydalmere. In a similar trial at Terranora Vegetable Station on the far north coast these varieties, and eleven other commercial varieties and three advanced breeding lines, were susceptible. This indicated a new race of rust, able to attack Redlands Greenleaf and Redlands Pioneer, in the Murwillumbah district.

The new race of rust was recently reported for the first time in Queensland, and is now known to be well established in northern districts of N.S.W. But it has not been detected elsewhere. All commercial dwarf-bean varieties are susceptible.

Inoculated under glasshouse conditions with the race of rust common in the Sydney metropolitan area, 14 advanced French bean breeding-lines were susceptible. One line was resistant. Two advanced navy bean breeding-lines were also resistant.

French Bean Anthracnose (Colletotrichum lindemuthianum).—The races of anthracnose are now being studied, particularly in relation to breeding for production of resistant varieties. Preliminary work has divided the 15 collected isolates into three groups.

Of fifteen advanced breeding-lines, 14 were resistant and one was susceptible to six isolates which did not attack Tweed Wonder. All lines were susceptible to another race which attacked Tweed Wonder. Cornell 49-242 was resistant to all isolates.

Cucurbit Powdery Mildew (Oidium sp.).—This, as usual, caused widespread rockmelon losses in the Murrumbidgee Irrigation Area and the Lower Murray district.

MUSHROOM CULTURE AND MUSHROOM DISEASES

Industry Size.—Over 6,000,000 lb per year is now the typical cultivated mushroom crop in N.S.W. Most of the crop is canned.

Quality of mushroom spawn from commercial spawn-producers continued to be satisfactory.

Diseases.—The eelworm *Aphelenchoides composticola* was found in compost at five localities in the Sydney metropolitan area and in compost from Macksville.

Mat mould (*Myceliophthora lutea*) caused moderate to heavy losses at four Sydney mushroom farms where peak-heating of prepared compost was not practised.

An isolate of white plaster-mould from infested compost at Riverstone was identified as *Scopulariopsis acremonium;* a first record of this species in N.S.W.

CITRUS DISEASES

The drought has seriously affected un-irrigated or inadequately irrigated trees. Many, particularly old trees with impaired root systems, have rapidly deteriorated.

Phytophthora Root- and Collar-rot.—The resistance of several varieties of citrus to stem inoculations of *Phytophthora citrophthora* was tested; ten plants of each variety. The indicated order of resistance was: Kara mandarin, Scarlet mandarin, Emperor mandarin, Ellendale mandarin, Dancy mandarin, Rough lemon, Acid mandarin, North Coast mandarin, Ruby Blood Sweet orange.

Emperor mandarin's rating (better than rough lemon) conforms with field observations that seedling Emperor trees perform better than trees on rough lemon stock. The Scarlet mandarin's status of relative resistance noted in previous root-rot experiments has been maintained.

Resistance of 46 isolates of *Poncirus trifoliata* to *Phytophthora* root-rot was examined. The test was severe but the trifoliata seedlings showed little if any root damage, whereas only one of ten rough lemon seedlings in the test survived. In contrast to American results the tested Australian trifoliata selections showed little variation in their resistance to *Phytophthora.* This is probably because Australian selections of trifoliata have been derived from a very low number of trees.

Tetrazolium was tested as an indicator of the extent of infection in *Phytophthora* root-rot of citrus. The interaction between 2, 3, 5-triphenyltetrazolium chloride and living tissues produces a colour reaction. This appears to intensify in proportion to degree of enzymatic activity of the plant tissue. No colour change occurred in tissues killed by the parasite. Rating of infection on unstained roots differed from that indicated by the colour test.

Attraction of *Phytophthora citrophthora* zoospores to citrus roots *in vitro* was studied. Chemotaxy of zoospores for citrus roots was evident within minutes of placing the roots in a zoospore suspension. The strongest effect was in the region of elongation. Many spores encysted, germinated and penetrated the root. More mature portions of root attracted zoospores in localized areas, possibly where wounding had occurred. Susceptible rough lemon roots and resistant *Poncirus trifoliata* roots were equally attractive to zoospores. It would appear that resistance to *Phytophthora citrophthora* is possibly a post-penetration phenomenon.

Grapefruit Stem-pitting Virus.—Observations in collaboration with Division of Horticulture continued, on the protection given under field conditions by mild strains of stem-pitting against natural infection with severe strains. Additional mild strains have been selected for further field-testing.

Scaly-butt (*Exocortis*) *Virus*.—Observations continued on Etrog citron stocks inoculated with buds from 100 Scaly-butt affected trees. The range of symptom development has been wide and there is a need to observe a number of growth flushes. The reaction appears to be modified by the Tristeza stem-pit virus-component present.

Psorosis Virus.—Indexing in all Departmental mother-trees is continuing.

In the search for non Scaly-butt lemons and the investigation of Yellow Ring in lemons, in collaboration with Division of Horticulture, flaky superficial scaling accompanied by deep vertical furrows was observed on four Eureka seedling selections on trifoliata stock at Somersby. The seedlings were Cambournes, Pauls, Greenlees and Taylors. Microscopically, this condition is different from Scaly-butt. Indexing of these nucellar selections on the Etrog citron did not give a positive Scaly-butt reaction.

Stubby-root Disease (?Trichodorus spp.).—Work continued on the relation between *Trichodorus* and a stubby-root condition of citrus. Dr Colbran of the Queensland Department of Primary Industries examined specimens of *Trichodorus* from Narara and regarded them as *T. lobatus* Colbran, 1965, rather than *T. flevensis* Hooper, 1962.

Attempts to show by inoculations that *Trichodorus* causes the condition have not succeeded. These are continuing.

Numbers of *Trichodorus* in seedbeds drenched with vapam (sodium-n-methyl dithiocarbamate dihydrate) three weeks before planting with citrus (rough lemon and trifoliata) were determined monthly. The nematode was recovered from samples taken two months after drenching, and after four months it had re-established populations of 200–300 *Trichodorus* per 250g soil.

In 1964, pre-plant application of vapam to the seedbed was shown to increase the growth of citrus seedlings. In a trial completed this year, seedlings from treated and untreated beds were planted in untreated vapam-drenched nursery rows. Plant growth, measured after 12 months in the nursery row, was increased slightly by the seedbed treatment and reduced slightly by the nursery row treatment. Stubby root and *Trichodorus* occurred throughout the nursery rows.

Black Spot (Guignardia citricarpa).—In the continuing spray trial in a 27-year-old block of Valencia orange trees, at Mangrove Mountain, seven fungicide schedules (3 sprays) were compared with a non-sprayed treatment in a 4-replicated randomized-block layout. Throughout the spring and summer several aspects of fruit quality were quantitatively determined on random samples. Harvested on 21st February the crop was graded for black-spot incidence. Incidence was not severe, and all programmes gave comparable control.

Percentages of clean fruit from the treatments were as follows: Bordeaux mixture 2½-2½-100-oil, two applications, followed by Zebtox-oil, 92 per cent; Bordeaux mixture 3-3-100, alkyl-resin wetting agent, two applications, followed by zebtox-oil, 91 per cent; cuprox 1.75 lb/100, two applications followed by zebtox-oil, 90 per cent; Bordeaux mixture 5-5-100, alkyl-resin wetting agent, followed by cuprox 1.25 lb/100-oil, followed by zebtox-oil, 87 per cent; cuprox 1.25 lb/100-oil, two applications, followed by zebtox-oil, 84 per cent; cuprox 1.25 lb-hydrated lime 0.5 lb/100-oil, two applications, followed by zebtox-oil, 84 per cent; cuprox 1.75 lb-hydrated lime 0.5 lb/100-oil, two applications, followed by zebtox-oil, 81 per cent; non-sprayed controls, 51 per cent.

Quality of fruit from sprayed trees was considerably improved, compared with the previous season, by limiting zineb sprays to a single application. As well, the percentage juice content, total soluble solids and percentage acid contents of fruit were improved by reducing the application of white oil at sticker strength in copper sprays.

In a supplementary trial on 27-year-old Valencia orange trees at Mangrove Mountain, combination schedules of copper fungicides and the dithiocarbamates—zineb (two applications) and antracol (two applications)—were compared. The copper fungicides included in the schedules were cupravit, perenox, cuprox and Bordeaux mixture.

Each of those schedules gave very good control of black spot and melanose diseases but there were considerable differences in fruit quality from the variously sprayed blocks.

Schedules that included two sprays of zineb depressed the juice content significantly and the fruit was insipid. Comparable schedules that included antracol increased the juice content significantly, and the fruit was palatable.

Time and frequency of application of Bordeaux and zineb sprays to Valencia orange trees was studied at the Narara Research Station. This concerned yield, fruit size and fruit quality. Bordeaux mixture 2½-2½-100-oil, five applications, commencing at petal-fall, greatly reduced yield and fruit size. Three- and four-spray schedules, commencing at petal-fall, reduced the yield noticeably but not fruit size. A three-spray schedule of Bordeaux mixture 2½-2½-100-oil, commencing 10 weeks after petal-fall, did not affect yield or fruit size adversely. The four- and five-spray Bordeaux schedules caused fruit to be bitter and reduced the juice content. Fruit quality was not adversely affected by eight zineb spray applications (2 lb/100 gal), but applications at petal-fall did reduce yield.

On the lighter soils at Mangrove Mountain, loss of internal fruit quality after application of two zineb sprays has been demonstrated.

Brown Spot of Emperor Mandarin (Alternaria citri).—The strength and frequency of copper oxychloride sprays required to control brown-spot leaf and stem infections on young calamondin trees were further studied at the Narara Research Station.

Three treatments, commencing at petal-fall, and an untreated control, were compared. The treatments were: weekly applications of 0.50 lb/100 gal, 27 applications; tri-weekly applications of 1.0 lb/100 gal, 10 applications; and six-weekly applications of 2.0 lb/100 gal, 5 applications. As well, half the plots received in mid August a pre-blossom spray of melprex 4.0 lb/100 gal. Development of leaf and twig lesions was light, and disease assessment was delayed until 30th May, 1966.

Pre-blossom sprays of melprex reduced the number of stem infections by about 50 per cent, but had little effect on number of leaf infections. Excellent control of stem infections was obtained by a pre-blossom spray of melprex followed by weekly sprays of copper oxychloride.

Weekly spray applications did not appear to be different to tri-weekly sprays in controlling leaf and stem infections. Six-weekly spray applications were superior to non-sprayed controls, but were inferior to the weekly and tri-weekly sprays.

Citrus Nutrition.—Collaborative with Chemistry Branch and Division of Horticulture, a nutritional pot-trial was continued at the Narara Station. The influence of various levels of nitrogen, potassium, calcium and magnesium on leaf composition, fruit quality and yield of Valencia oranges is being examined. Samples of spring-flush leaves were collected from all trees in February for determination of nutrient contents.

DISEASES OF POME FRUIT

Virus Diseases.—Transmission tests in a number of suspected virus diseases were continued at Narara but there were no further symptoms of transmission. The tests have ended and the trees are to be removed in 1966 winter.

Indexing of one Red Jonathan apple tree is now almost complete. The only disease observed during two growing seasons was Chlorotic-leafspot virus. Indexing of this tree will be complete when chemical staining tests have checked for the presence of mild rubbery-wood virus.

Buds from this tree have been subjected to heat therapy, at 100° F for thirty days. Growth from these buds was removed and budded on to virus-free seedlings. Subsequent growth was used to inoculate a range of indicator hosts, to check the efficacy of the heat-therapy. Results of the re-indexing will be available during the next two seasons.

The first season's results from indexing twelve recommended Granny Smith apple budwood-source trees, and two selections of Northern Spy apple rootstock, show that Chlorotic leafspot virus is present in all fourteen. Observations on symptom transmission will continue.

During March and April, 1966, the necessary inoculations were done to index six recommended Jonathan apple trees, six Red Jonathan trees which have been subjected to heat therapy, and one McIntosh apple tree with symptoms of a suspected virus disease. Results from these indexings will be observed over the next two growing seasons.

A suspected new virus disease of pears continued to be investigated. The results to date show that the symptoms are bud-transmissible to Williams' bon Chretien pear. Further inoculations were done in March, 1966, on to a complete range of pome and stone fruit indicator hosts, to identify the virus or viruses involved. Experiments are to be set up to determine the effect of the disease on growth of nursery trees, and to determine whether the virus or viruses involved can be mechanically transmitted to herbaceous hosts.

The Deciduous Fruit Tree Improvement Committee continued its work. Orchard surveys of recommended budwood-source trees resulted in elimination of some from the list supplied to nurserymen. Replacement trees were selected where necessary.

Apple Scab (Venturia inaequalis).—Ascospore production in spring was greatly restricted, probably by the extremely dry 1965 winter. Ascospore discharge in the non-sprayed orchard at Orange, where measurements for the spray-warning service are recorded, was the lowest since recordings began in 1957. The *Spray-warning Service* was continued at Orange in association with Division of Horticulture.

At Bilpin, six infection periods occurred between 16th October (full bloom) and 12th December. Infection was heavy in a few orchards.

Concerning scab control by suppression of inoculum: No fruit- or leaf-scab lesion was found this year in the sixty Granny Smith trees at Maroota, sprayed with phenyl mercuric chloride each autumn since 1955. In the 1966 autumn the mercury treatment was replaced by post-harvest treatment with 5 per cent urea.

At Bilpin, urea and PMC were compared as post-harvest treatments for inoculum suppression and scab control on heavily infected Granny Smith trees. Treatment effectiveness was measured in spring by counting lesions on potted small Granny Smith trees used as biological spore-traps and exposed to single infection periods. Results were also measured on protectively sprayed and the non-sprayed orchard trees after six infection periods.

These measurements showed reductions of 99 per cent and 94 per cent in the number of ascospore infections in spring after post-harvest treatment with 5 per cent urea and 0.02 per cent PMC respectively. Urea seemed to fail to suppress adequately the conidial inoculum carried over the winter, except where the autumn urea-treatment was supplemented by a bud-burst 0.02 per cent PMC spray.

After six infection periods, fruit infection in non-protected trees in eradicant-treated areas was compared in January with that on protectively sprayed trees in the area not treated with eradicants.

The results indicated that 0.02 per cent PMC in autumn, 0.02 per cent PMC in autumn plus 0.02 per cent PMC at bud-burst, and 5 per cent urea in autumn plus 0.02 per cent PMC at bud-burst were each as effective for scab control as the grower's spring and summer programme of seven protective sprays. Urea in autumn only, and PMC at bud-burst only, were less effective.

Concerning effect of autumn urea spray on overwintering leaves: Despite the extreme drought of the late autumn and winter, a post-harvest spray of 5 per cent urea hastened the rate of leaf decomposition, particularly where leaves overwintered in contact with the soil.

Sampling of the orchard floor at the beginning and end of winter revealed no significant reduction in dry weight of leaf per acre in the non-treated area or in the area treated with PMC 0.02 per cent in autumn. But leaf weight was reduced by 35 per cent in the area treated with 5 per cent urea in autumn.

Nitrogen content of urea-treated and non-treated leaves one week after spraying was 2.21 per cent and 1.46 per cent respectively; and the total bacterial contents of such leaves after two months overwintering were in the ratio of 24 to 1 respectively.

Concerning ascospore productivity in relation to time of leaf-fall: Previous investigations in N.S.W. and in England have indicated higher ascospore productivity in the leaves cast towards the end of the leaf-fall period. Further investigation of this effect at Bilpin during 1965 showed a strong reversal of the previous trend. This may have been related to rainfall. The only rain between 14th April (0.11 in) and 25th July (2.40 in) fell on 8th May (0.07 in), 9th May (0.30 in) and 14th June (2.18 in). Leaves cast in March and early April experienced alternate wetting and drying soon after falling and produced an expected relatively low number of ascospores. Later castings produced less than one-third of this number.

Concerning ascospore-dispersal investigations: Investigations in England and field observations in N.S.W. suggest that the majority of ascospores may be deposited within less than 100 feet from the edge of an inoculum source.

During a rain period in spring 1965, potted young Granny Smith trees at Rydalmere were arranged in semicircles at 10-ft intervals to leeward of an inoculum scource. But ascospore productivity of the overwintered leaves was so low that no lesion developed even on the nearest trees.

At Orange a circular area within a small, non-sprayed apple orchard was sprayed with 0.05 per cent PMC in autumn and with 0.02 per cent PMC in spring—to eradicate scab inoculum within a 150-feet diameter circle. Attempts were made to measure a gradient of infection across the circle after the first two ascospore infection periods. The attempts failed because of the low ascospore productivity of the overwintered infected leaves surrounding the circle.

Concerning screening of autumn treatments for suppression of perithecia: Heavily scabbed senescent Granny Smith leaves were picked from trees at Bilpin on 31st May, 1965, and dipped in a range of 25 treatment solutions and suspensions

200 leaves per treatment. These leaves were overwintered in large, fibreglass-mesh envelopes on open ground at Bilpin and tested for ascospore productivity through the spring. But ascospore productivity of the five control samples was so low, due to the extremely dry winter, that reliable comparisons between treatments could not be made.

Concerning effect of autumn treatments on microbial content of overwintering leaves: Six weeks after treatment in the screening experiment, samples of ten leaves were taken from thirteen of the overwintering envelopes, for estimation of total bacterial content. The treatments sampled involved various sucrose and nitrogen concentrations and combinations of these. Sucrose 2 per cent and 5 per cent did not influence bacterial content at the time of sampling, but bacterial numbers increased with increasing urea concentration from 1 per cent to 5 per cent. They decreased progressively with higher concentrations of urea (7½ per cent and 10 per cent).

Sulphate of ammonia and nitrate of soda were used as autumn treatments at rates giving the same nitrogen concentration as 5 per cent urea. The ratios of total bacteria in these treatments to the control (water-dip) treatment were respectively 1: 1, 8: 1, and 67: 1. Mould counts, however, revealed a reverse relationship. The respective mould ratios were 11: 1, 4: 1, and 0.2: 1.

Mercury, after Post-Harvest Sprays.—Last year, analyses of bark from one-, two-, three-, and four-years-old growth on Granny Smith apple threes, which had been sprayed each autumn with 0.05 per cent PMC, revealed increasing accumulation of mercury in or on the bark with each increase in the number of sprays applied. Mercury was not detected in the current season's growth, which had not been sprayed.

The investigation continued this year. Further bark samples were taken and inner and outer bark are being analysed separately, to determine whether the accumulation of mercury is throughout the bark or confined to the outside. Bark samples from main limbs, trunks, and roots are being analysed also. Results of analyses are not yet available.

Oil-Mercury Combination at Green Tip.—Compatibility charts generally list oils as incompatible with mercury compounds. There seems to be no chemical or physical incompatibility between superior winter oil and phenylmercuric chloride. This mixture could be very useful for combined scab, mite, and scale control on some fruits at green-tip.

In a trial at Orange, no phytotoxic reaction resulted from sprays of PMC 0.02 per cent plus X-77 spreader or PMC 0.02 per cent plus 3 per cent oil applied to Granny Smith apples and Williams pears at green-tip and to Packham's Triumph pears at late green-tip.

Apple Mildew (Podosphaeria leucotricha).—An epidemiological investigation was commenced in a Jonathan apple block at Bathurst Research Station. A Hirst spore-trap was set up in the centre of each of two nine-tree squares about 200 feet apart. The trees in each of these squares remained unsprayed for mildew control. In this first year of the investigation the inoculum concentration in the trapping areas did not rise above the detection threshold of the spore traps.

DISEASES OF STONE FRUIT

Virus Diseases.—Transmission tests for a number of suspected virus diseases continued at Narara. There was no further evidence of symptom transmission. However, some of the conditions have been transmitted during indexing work at Rydalmere. The Narara tests have ended. The trees will be removed in the 1966 winter.

Indexing of seven recommended cherry budwood-source trees has resulted in detection of Prune Dwarf virus for the first time in New South Wales. This virus was transmitted to the indicator host from all seven of the cherry trees being indexed.

Inoculations were done in March and April, 1966, to index a further six recommended cherry trees, one apricot tree suspected of infection by a new virus disease, one cherry tree showing severe symptoms of a multiple virus infection, and two ornamental *Prunus* species showing symptoms thought to be due to virus infection. Results are not yet available.

Cherry dieback on Mahaleb stocks will be further investigated. A statistical design has been determined for the experiment. The necessary stock-scion workings have been undertaken by Division of Horticulture. This trial will make use of virus-free Mahaleb seed from America, to determine whether the dieback is due to a virus and, if so, whether the virus is coming from the stock or the scion.

The Deciduous Fruit Tree Improvement Committee continued its work. Inspections of budwood-source trees have eliminated some. These have been replaced.

Brown Rot (Monilinia fructicola).—The possibility of eradicating the brown rot fungus from blighted peach and apricot blossoms was examined. Complete eradication by any of several fungicides, including PMC and sodium arsenite, was shown to be unlikely.

Preliminary studies showed several fungicides to have good potential for eradicating or preventing quiescent infections in apricot fruits.

The green-fruit rot phase was studied again. The role of dried fruit beetles (*Carpophilus spp.*) as important vectors was established beyond doubt. Some research showed bees to be of doubtful importance as carriers of primary inoculum in spring, but they may cause significant spread of secondary inoculum. Further work is planned.

Of epidemiological importance, it was found that brown rot spores are stimulated to germinate by gasses produced in ripe fruits and that the degree of stimulation varies with spore age. Gases from green fruit do not stimulate germination. The work is continuing.

UNEXPLAINED DEATHS OF DECIDUOUS FRUIT TREES

Examination of the Murrumbidgee Irrigation Areas fruit tree census revealed that deaths and removals of deciduous fruit trees are costing growers considerable money and income-loss each year. Trees of all ages are being lost. Some of these deaths can be explained but the causes of most are obscure.

A limited survey has indicated that in most cases root rots may be involved. It seems that Pythiaceous fungi may initiate attack and cause death of small roots and rootlets, while a variety of basidiomycete species rot the larger roots and butt.

Two species of *Phytophthora* have been isolated from peach and plum roots. The most significant basidiomycete remains unidentified. Further work is in progress.

DISEASES OF GRAPEVINES

Downy Mildew.—For the third successive year this disease was at a minimum. There were no results in a Spray Demonstration Trial at Orchard Hills, because of absence of downy mildew.

Phytophthora Root Rot.—Cause of a root rot and death of vines on a second property at Orchard Hills has now been established as *Phytophthora cinnamomi*. In this one-acre block of Black Muscat on Du Lot rootstock, planted in 1958, 250 of 690 vines have died during the past four seasons.

Dead Arm.—The dry spring conditions in the Murrumbidgee Irrigation Areas were not conducive to dead arm. So no result was obtained from a spray trial comparing three chemicals as dormant sprays—with and without lime sulphur at budburst.

DISEASES OF TROPICAL FRUIT

Banana Leaf Spot (Mycosphaerella musicola).—This in general was mild.

Banana Speckle (Mycosphaerella musae).—This was unusually prevalent in some areas.

Banana Bunchy-top Virus.—Incidence remained low.

Banana Blackend (Gloeosporium musarum).—In trials of the efficiency of banana dipping-solutions to control blackend, dithane M45 gave some control, but was not superior to salicylanilide and it flocculated in the presence of banana sap —particularly when mixed with sodium salicylanilide.

Passion-Fruit Fusarium Wilt.—In collaboration with Division of Horticulture, breeding to combine field resistance of *Passiflora edulis f. flavicarpa* with the desirable agronomic characters of the black passion vine (*P. edulis*) was continued.

Inoculated with *Fusarium oxysporum f. passiflorae*, selfed F_4 plants that had been planted in infected soil at Kulnura made little growth during the drought of the previous season. A number of plants that succumbed to the dry conditions were replaced with similar genetic lines. In the 1966 autumn some vine losses due to Fusarium-wilt infections were recorded. But most plants made very satisfactory growth.

DISEASES OF STRAWBERRIES

Black Root Rot.—In a Narara trial, soil treatment with sodium methyl dithiocarbamate gave better control of the disease than all other treatments. It produced healthy plants, with very little root rot. Fruit yields were increased by 60 per cent compared with the untreated control.

In previous seasons this treatment has resulted in poor growth and low yields, apparently due to phytotoxicity. In 1965 an interval of 37 days was left between treatment and planting, compared with 16 and 18 days in the two previous seasons.

The 1:2 dibromo-3-chloropropane treatment also gave increased fruit yields, 50 per cent more than the untreated control, but control of black root rot was not as good as with sodium dithiocarbamate.

In another Narara trial the effect of various rotation systems on incidence of black root rot and the yield of fruit has been examined. In plots which have now grown strawberries for three consecutive years, black root rot was severe and fruit yields were only one-quarter of the yields in plots which had been spelled for a year. This trial is also comparing the effect of growing soybean and cocksfoot as rotation crops. These treatments have not yet yielded results.

Virus Diseases—Heat Therapy.—Following failure to find any virus-free plants of Kendall, the most popular commercial variety in N.S.W., production of virus-free plants by heat therapy was commenced.

Plants are kept in a room maintained at 100° F, artificially illuminated with fluorescent light. Indexing results have shown that two weeks is insufficient treatment to free from viruses any of the varieties treated so far, and that for the varieties Richmond Red and Majestic four weeks' treatment is insufficient. One Kendall plant, treated for 25 days, is still virus-free after 12 months. This plant has been propagated and planted in a trial to compare it with a number of virus-infected clones of Kendall.

DISEASES OF ORNAMENTALS

Sun scorching of foliage, and damage due to excess salinity of water, continued to be very common disorders of ornamental plants in the metropolitan area and other parts of the State. Azaleas were noted to be particularly susceptible to sunscorch.

Azalea petal blight (*Ovulinia azaleae*) was severe in the spring and early summer, related to the weather conditions.

Powdery mildews were severe and widespread on several hosts.

Rhododendron resistance to Phytophthora cinnamomi—Resistance to *Phytophthora* root-rot, in three cultivars used as rootstocks, was evaluated in a glasshouse experiment. *Rhododendron* cv. "Cunningham's White", *Rhododendron* cv. "Elegans" and *Rhododendron ponticum* plants were growing together with the fungus, in water-saturated soil and in soil of normal water content.

In the normal water content conditions the cultivar "Elegans" and *R. ponticum* showed complete resistance to the fungus, while 30 per cent of the "Cunningham's White" plants were killed. In the water-saturated conditions 50 per cent of the "Elegans" plants, 70 per cent of *R. ponticum* and 77 per cent of "Cunningham's White" were killed.

None of the three varieties is apparently totally resistant to the fungus, although their susceptibility appears to vary. In normal conditions "Elegans" and *R. ponticum* should be fairly satisfactory rootstocks.

Quarantined Ornamentals.—A large number of ornamental plants imported from overseas were quarantined at Rydalmere. Their total for the year is 234. There was also 525 chrysanthemum plants and 204 carnation plants quarantined here, as part of an experiment on quarantine treatment done in conjunction with the Assistant Director-General of Plant Quarantine.

Several interceptions of disease were made including two virus diseases of *Dendrobium* orchids which apparently have not been described before.

Biology Branch—Bacteriology Section

SOIL BACTERIOLOGY

Bacteriologist Seconded to CSIRO.—An additional bacteriologist was appointed this year to work on problems associated with symbiotic nitrogen fixation, and has been seconded to work for three years in conjunction with the CSIRO Division of Plant Industry, Canberra.

Testing Commercial Legume Inoculants.—Two legume inoculant quality surveys were conducted. Improvement in quality of inoculants for temperate legumes was found. Only 12½ per cent failed to meet the arbitrary standard, compared with 25 per cent in 1964–65. Inoculants for summer legumes remained of poor quality; 66 per cent failed to meet the standard.

Rhizobia Growth and Survival in Peat Cultures.—This project continued for the third year. Again valuable financial aid came from the Australian Meat Research Committee funds.

The most promising result of this research so far has been the dramatic improvement in both growth and survival of rhizobia in peat sterilized by gamma radiation. This sterilization method proved superior to autoclaving and allowed use of 0.002 in. low-density polythene packages. It allows the number of cells in cowpea cultures to be increased to at least 100 times the number at present being produced in unsterile peat.

Further advantages of pure-culture inoculants have been shown to include improved survival at high storage-temperatures and easier laboratory-control of their quality.

DAIRY BACTERIOLOGY

Cheese Starter Cultures.—The Bacteriology Section continued to supply starters for cheese, yoghurt, and cultured buttermilk to the N.S.W. dairy industry. This year 1,165 starter cultures were supplied, about 300 less than in 1964–65.

In particular, the number of requests for *Streptococcus lactis* and *Streptococcus cremoris*, normally used for cheese manufacture, declined. This indicates that dairy factories are improving their techniques and are better able to maintain their cultures and keep them free from contamination.

The number of requests for starters for cottage cheese, yoghurt and cultured buttermilk increased. There has been an increase in the manufacture of cheeses other than cheddar. Cottage cheese production in particular, American and European styles, has increased.

Butter Quality.—Microbiological analyses of manufactured bulk butter (56-lb boxes) consigned from country factories to the Central Grading Floors in Sydney, Granville and Newcastle, were done regularly during the main producing months —October to April. As far as possible a weekly sample was taken from each of the butter factories.

Butter samples analysed for total counts, casein digesters, yeasts and moulds, coliforms and staphylococci totalled 576. The results, with suggestions for improvement in factory hygiene, processing and handling of cream and butter, were forwarded to extension officers and factory managers. Quality of bulk-butter, as compared with results of the 1964–65 survey, has slightly declined.

Biological quality of retail print-butter in country and metropolitan areas was surveyed. The surveys involved 85 and 100 samples respectively. Results of surveys of this kind are useful to advise processors, distributors and retailers, and help to improve sanitation and handling methods.

Seven surveys of butter processing plants were undertaken; 12–28 samples from each plant, analysed microbiologically. As far as possible, one sample is followed through each mechanical operation. The results of these analyses indicate where improvements in hygiene and cleaning techniques are warranted.

Biological Cheese Quality.—Bacteriological analyses of all varieties of cheese produced in N.S.W. were continued. Cheese samples are tested for coliform and staphylococcal contamination. In general the bacteriological quality has declined. The information gained is useful for field officers and factory personnel in improving the hygiene in manufacture techniques.

Antibiotics in Dairy Produce.—The Stock Foods and Medicines Act as from 1st July, 1966, requires penicillin and certain other antibiotics, when sold in the form of intramammary infusions, to contain a marker dye "Brilliant Blue FCF".

Work has been done to enable detection of the dye down to a level of 1/32 p.p.m. by a resin-absorption method.

Division of Dairying and the Bacteriology Section of Biology Branch are co-operating to train dairy officers, Milk Board officers and factory personnel in this resin test.

Other Services.—Bacteriological defects in food products were investigated on behalf of commercial firms. On several occasions samples of water, yoghurt, and starters with cheese thought to be unsatisfactory were bacteriologically analysed.

Entomology Branch

GENERAL

Committees.—The Entomology Branch was represented in a number of committees concerned with research and policy. These included the: Australian Agricultural Council Sub-committee on Pesticides Residues in Animal Products (resulting from dipping and spraying and from pastures); Australian Agricultural Council Commodity-Treatment Sub-committee; Australian Agricultural Council Technical Sub-committee on Pest Management in Pome Fruit Orchards; National Health and Medical Research Council Sub-committee on Pesticide Tolerance in Food; Department of Labour and Industry Sub-committee on Rural Poisons and Diseases; Health and Agriculture Inter-Departmental Committee; Standards Association Sub-committee on Common Names of Pesticides; Argentine Ant Eradication Committee; and Pest Destroyers Act (1945) Committee.

Co-operative, Integrated Pest Control in Pome Fruit Orchards.—By direction of the Standing Committee on Agriculture, a Technical Sub-committee, comprising representatives of Entomology Divisions or Branches of the CSIRO and the Departments of Agriculture in Victoria, New South Wales, Tasmania and South Australia, was set up to plan and recommend a co-operative research programme—to explore the possibilities of developing an integrated pest-control programme in pome fruit orchards. Experimental units are to be set up in all co-operating States.

In New South Wales two units will be established, one at Bathurst and one in the M.I.A.

A uniform procedure of spray application, based on the insecticide ryania and possibly *Bacillus thuringiensis*, will be followed in all areas. Studies of Arthropod populations, and assessments of infestation of natural-enemy activity, will be similarly performed. The project is initially planned as a three-year study.

Commonwealth and State Entomologists' Conference.—The Chief Entomologist and Senior Entomologist represented N.S.W. at the biennial conference of Commonwealth and State Entomologists in Melbourne in November, 1965. Entomological matters of common interest were discussed. These included locust and grasshopper control, biological control, control by sterilization techniques, insecticide residues, insecticide application, resistance, orchard pests, stored product pests, field crops pests, distribution and reporting of pests, and new-perspective approach to insect control.

UNESCO Seminar on Science Policy and Research Organization.—The Chief Entomologist attended in August, 1965, as Australian delegate, the UNESCO Seminar organized by CSIRO for countries of South and Southeast Asia on "Science Policy and Research Organization". Research directors from organizations in Pakistan, India, Nepal, Korea, Malaysia, Hong Kong, Japan, Thailand, Vietnam, Philippines and New Zealand attended for the three weeks' Seminar at St Andrew's College, University of Sydney.

PASTURE AND FIELD CROP PESTS

Australian Plague Locust (Chortoicetes terminifera).—This was one of the lightest years for locust activity, at least since 1953. There was no report of any swarming activity until February/March. Then, a few scattered bands and swarms were observed. These included a large flying-swarm south of Lake Cargelligo, in the Yelkin district. An unconfirmed report of dense, flying locusts between Hillston and Roto was also received; and a few nymphal bands near Dunedoo. There were localized areas of dense bands in Narrabri district. Control action was taken in the Dunedoo and Narrabri areas.

Surveys and reports also indicated an increase in the non-swarming populations late in the season. So, pockets of infestation occurred. Although of no immediate consequence these could be significant in the next spring-generation. Egg laying by these scattered locusts seemed heavy in the areas surveyed in detail by the patrol service.

In the prevailing drought conditions, particularly in the northern half of the State, pockets of infestation were often the localized strip-storm areas. However, despite the dry conditions, there seemed a general increase in the overall locust population from the very low levels observed in spring and early summer.

Thus, the season ended on a rising cycle as distinct from that of the previous year, 1963–64. The next season, 1966–67, could be a most interesting one. Some activity of consequence is expected.

Further information about locust activity since 1962 and many miscellaneous reports from field officers, together with reports from Departmental files, were supplied to Dr Magor of the CSIRO. This is to assist her work on analysis of outbreaks extending back into the 1930's.

Detailed records of three examples of well-defined locust swarm-movements were compiled for Dr Rainey, Anti-Locust Research Centre, for analysis in relation to prevailing weather conditions—his co-operative project with CSIRO officers. Subsequently several other promising examples have been located for comparison with weather and these may allow more general conclusions to be reached on weather's influence on locust activity.

The study of phase changes continued. Specimens from field-collected samples and further specialized collections were measured. So far, 44 series have been assembled (four this year) from a variety of situations. Measurements have been completed for 28 of these (19 this year).

One series from Nocundra in southwest Queensland received special attention. The series contains specimens collected in March, 1965, by CSIRO and Anti-Locust Research Centre survey teams working in the area (see 1964–65 Annual Report of this Department).

A series collected this year from very low density, solitary populations in the Trangie area was of special interest. These are providing comparisons with collections from higher-density populations. Another interesting feature was that 20 to 25 per cent of female locusts captured near Trangie in December were parasitized by Nemestrinid-fly larvae, described in 1936 by N. Noble as *Trichopsidea ostracea*. Adults of this parasite were also captured flying about the paddock. Such a high percentage of parasitism was not expected in the prevailing low-density locust populations.

In October, 1965, the locust patrol officer accompanied a CSIRO survey team into southwest Queensland and western N.S.W. to gain experience of the country and of the locust situation in these remote areas. In late January, 1966, a programme involving extensive survey work in the major outbreak areas was arranged for him. These areas extend from the Coonamble district in the north to the Forbes/Condobolin district in the south; from the Canonba district in the west to the Dubbo/Coonabarabran districts in the east. Excellent coverage has been given to this very large area, but any extension of the area to other districts of interest would reduce the overall efficiency of his activities. His visits to such other areas will be restricted to those that arise from an occurrence of special interest.

The detailed surveys feature the counting of locusts flushed in a 1,000-yard transect, walked at frequent intervals along the survey route. A quantitative picture of the locust-density has thus been built up for the second locust-generation of the season and areas of potential danger have been pinpointed. Transect counts have been indicated on a large-scale map of the area and these have been divided into grids. Each grid has been coloured according to an arbitrary scale of density levels. Changes in density from one locust-generation to another, and changes in the areas infested, will be readily seen from these maps.

The patrol officer's programme has been designed to fill some of the gaps that are inevitable in the information provided by Pastures Protection Boards—particularly the gaps during the period prior to and whilst the early locust-swarming is occurring.

The monthly report maps filled in by the Pastures Protection rangers are not suitable for the type of detailed information now needed. Report cards based on those used by the Red Locust International Control Service in Africa, but adapted for local conditions, were designed this year. These will be distributed to Pastures Protection Boards and to the locust patrol officer for general field-use. These cards replace the system which was devised in 1938.

Wingless Grasshopper (Phaulacridium vittatum).—During September and October, 1965, hatching of eggs laid in the previous season was widespread. By November, very heavy infestations were evident over extensive areas on the northern tablelands. The insect was declared a noxious pest by the Minister for Agriculture and arrangements were made to supply quantities of technical malathion to landholders. This followed successful trials with this material in the Walcha district in February, 1965. When the campaign finished in December, 1965, many thousands of acres had been aerially sprayed by this new technique in the Pastures Protection Districts of Armidale, Tamworth, and Glen Innes.

Even as early as October, 1965, the general situation was somewhat different from that experienced in other areas in previous seasons. Following the previous summer's heavy infestation, hatchings were much more extensive. Areas of dense infestation were not confined to specially favoured sites of limited size. They were spread over hundreds of acres.

Extremely dense infestations even at this early stage were on warm, sheltered and well-drained slopes but connected by big areas quite seriously infested. The combination of dry conditions, in what is normally a fairly high rainfall zone, usually intensely grazed by sheep and cattle, and widely pasture-improved, probably explains these extreme-infestation levels. That combination of factors has not occurred in this area for many years. Not only *Phaulacridium* was favoured by these conditions. Other species, particularly *Brachyexarna* sp., *Austroicetes* sp. and, later, *Gastrimargus musicus* were also prevalent in many areas.

In a trial at Walcha two rates of application of L.V. malathion were used. The malathion at 4.6 fluid oz and 5.6 fluid oz per acre gave equal control under the conditions. About 70 per cent kill was achieved after one day, rising to about 80 per cent after 11 days. The residual-life of the insecticide was very short; bulk of the total effect occurred within two to three days.

In further trials at Walcha the results were: 2.5 to 3.5 oz of thiocron per acre, 40 to 45 per cent control; 6.5 oz of malathion, about 75 per cent control; and 2.3 oz fenitrothion (sumithion), 80 to 90 per cent control. No valid estimate was possible with bidrin, except that it killed large numbers of hoppers. Each insecticide was applied by the ultra low-volume method at a total volume of 8 oz of fluid per acre. Verification trials are needed, except for malathion.

Marching-behaviour was marked from late November to mid-December. Very dense bands were on roads, particularly in the Walcha district. Some individual bands extended for 2½ to 3 miles. Local movement and spread of infestation was common after this and continued through January. But wide-scale concerted-marching ceased. This general loosening and broadening of infestation in late December and January was less spectacular than the earlier movement. Such dense concerted-marching of *Phaulacridium* is not common.

The results of the overall campaign have been hard to assess. The trials indicated about 80 per cent control could be expected under average conditions, but apparently this was insufficient in some cases. In the Walcha district particularly, comparison was often made with the February, 1965, trial and commercial sprayings—whereby kills exceeding 90 per cent were achieved.

It was established that the rate of application used for the campaign was, in fact, lower than that used in the trials. This arose from confusion over American recommendations, thought originally to be in U.S. fluid oz rather than Imperial fluid oz. The February trials were carried out at 8 Imperial fluid oz technical malathion per acre; the campaign spraying was at 8 oz weight technical malathion (6½ fluid oz) per acre. The swathe width was increased from 33 paces to 42 paces so that there was about 20 to 25 per cent reduction in active ingredient applied per acre. This could have resulted in less efficient coverage, and a more patchy result under marginal conditions.

All future treatments with L.V. malathion should be at not less than 8 *fluid* oz per acre, at least until further trials establish whether lower dosage rates are less efficient.

Landholder-reaction ranged from very satisfied to dissatisfied. Kills ranged from spectacular to poor, according to reports. Complaints could be traced to a variety of causes. These included incorrect landholder-assessment of results, incorrect application, difficult terrain—steep valleys, timbered hills, heavy bracken cover, etc., and combinations of these factors.

When the campaign closed, there were still many applications pending for treatment of infested properties. The area treated exceeded 150,000 acres but was only a small fraction of the total area infested.

Damage to pastures was very severe. Even as early as 14th October, 1965, the grasshopper-densities in the Walcha district were over 50 per square foot and causing severe foliage-damage to young grasses and clovers. Also in October, heavy infestations on the basaltic hilly-country north of Guyra had caused extensive bare patches in improved pastures. This damage increased throughout November and early December until whole paddocks were denuded of cover. An almost pure stand of cocksfoot near Guyra was eaten down almost to ground level. This paddock was sprayed with L.V. malathion and, after 4 to 5 inches of rain in early December, showed an excellent regrowth of grass. Other parts of the property that had not been sprayed failed to respond.

Heavy infestations were able to keep pastures very bare, particularly where stock were also there. Sheep-grazing properties were the worst affected, and during November many thousands of acres were literally eaten into the ground. District-wide it became difficult to separate the effects of grasshoppers, drought, and stocking-rate. Each contributed significantly to the situation.

There is no doubt that aerial spraying provided considerable relief in areas not treated early enough for full benefits of treatment. The effect of later spraying was not nearly so clear-cut, due to lack of follow-up rains.

Many thousands of gallons of lindane were also supplied by Pastures Protection Boards for ground spraying. Reports have indicated that it generally provided efficient control.

During May, 1966, in collaboration with Cyanamid (Aust.) Pty Ltd, spray-droplet analysis trials were done at Camden airport—applying various rates of malathion with various nozzle-settings. There will be further trials, to determine the best method of applying malathion at ultra low-volume rates to get even-coverage under field conditions. The method offers a great deal of promise for the control of other grasshopper species besides *Phaulacridium*. But that very precise knowledge of the way the material is being distributed and deposited on the ground is needed.

Black Beetle (Heteronychus arator).—A high population of black beetles developed, following the previous dry summer, and caused concern in the spring. Activity began in September in far north coast areas, and a little further south. Widespread outbreaks and swarmings occurred throughout coastal farming districts. They seriously attacked early-sown maize and also other fodder and vegetable crops—including potatoes. Activity waned during midsummer but there were cases of damage to maize, and some occasional swarms, in late January and February in the Clarence, Manning, Hunter and Shoalhaven Rivers districts.

With another dry summer, the effect of larval-feeding on grass roots was seen in established pastures in February and March. The worst areas were the Shoalhaven flats. Scattered infestation areas were reported in the Bega, Taree and Macksville districts. With advent of cooler weather, damage ceased by April.

Another high beetle-population is now overwintering in the soil. Further serious damage may be anticipated in the 1966 spring.

Black beetle was again reported at Albury, but damage there has so far been only in home-lawns within the city boundaries. Black beetles were also recorded from the M.I.A. but no damage was noted. An unusual instance of severe damage to a legume crop was recorded at Grafton when *Desmodium uncinatum* was attacked by black beetle adults. Broadcast "BHC-cracked corn" bait gave very good control and the crop came away well.

White-Fringed Weevil (Graphognathus leucoloma).—Damage to lucerne and clover by the larvae was reported in September and October from Taree, Parkes and Macksville. In February there was widespread larval-damage to lucerne at Taree, and adults began to appear at Macksville and Taree. In late summer and early autumn there was widespread damage to lucerne stands at Parkes, Taree, Macksville and East Maitland.

In August, 1964, aldrin (2 lb a.i. per acre), dieldrin (2 lb a.i. per acre), heptachlor (2 lb a.i. per acre) and ethyl parathion (0.5 lb a.i. per acre) in powder or granulated form were incorporated into the soil with superphosphate by sod-seeder at Taree. The insecticides were then mixed in the soil by discing. Because of seasonal conditions, a crop of *Dolichos lablab* was sown in November, 1964, in place of lucerne. This was grazed and later ploughed out in May, 1965. Lucerne was then sown at 15 lb per acre in July, 1965, with 2 cwt per acre of 50/50 lime superphosphate and 8 oz molybdenum trioxide per acre. An excellent stand of lucerne was established and some evidence of a mild infestation of white-fringed weevil was developing.

The first pest-treatment counts in December, 1965, showed no larvae or damaged plants in the aldrin and heptachlor plots, 1 larva in the dieldrin plots, 15 larvae in the ethyl parathion plots, and 12 larvae in the control plots. At a second post-treatment count, in February, 1966: the aldrin, dieldrin and heptachlor plots were free from larvae and damaged plants; 11 larvae were found in the parathion plots and 13 in the control plots.

In lucerne stands at Cowra treated with dieldrin at 1½ lb a.i. per acre in August, 1959, prior to sowing in September, 1959, and in lucerne stands at Canowindra treated at 0.9 lb and 2 lb a.i. per acre in December, 1960, prior to sowing in April, 1961, larval-numbers were much lower than in the untreated areas when the regular annual-observations were made in September, 1965. The counts averaged 0.4 larva per square foot in treated and 1.35 per square foot in untreated areas at Cowra; and respectively 0.75 and 0.8 per square foot in the 0.9 lb and 2 lb treatment, and 2.6 per square foot in the untreated area at Canowindra.

The treatments appear to be losing their effectiveness. Populations in them this year were much higher than last year when 0.1 larva per square foot was recorded at Cowra and 0.05 larva per square foot at Canowindra.

White-fringed weevils were also seen in association with apple trees at March, near Orange, and suspected of extensive root-injury to the trees.

Lucerne Flea (Smynthurus viridis).—Lucerne-flea infestations were noted at Canowindra and along the Belubula River flats in July. In one case the insects were in a barley crop near infested lucerne. Patchy infestations were also reported in the Albury district from July to November, but in small numbers. Only one case there, a heavier attack on a young lucerne stand in October, needed a control measure.

In the Belubula River area control was satisfactory with a single application of imidan at ¾ oz a.i. per acre, timed to within 2–3 weeks of hatching. In cases where application was delayed, a second spraying was needed.

Late in November, 1965, a Baulkham Hills area where a small outbreak was first discovered in the spring of 1962 and where lucerne fleas reappeared the following autumn and spring was inspected. There was no sign of fleas at this time nor effect of their feeding. But the property-owner reported that lucerne fleas were present and he had applied malathion spray earlier in the month.

Sitona Weevil (Sitona humeralis).—The recorded range has been extended. The pest is now known to be present throughout the central and southern slopes and tablelands, the Hunter River Valley and the M.I.A. In the Bathurst district in September the pest was active in lucerne paddocks and considerably damaged newly-sown lucerne. Lucerne-damage reports came also from Doyalson and Parkes in October, 1965, and from Bungendore in January, 1966.

In biological investigations, 25 pairs were maintained at room temperature for over 90 days. In this period the total of eggs per female ranged from 68 to 1,250 with a mean of 507. The full-adult period extended for over nine months. Mating occurred at intervals during egg laying and greatest activity was in the spring and autumn. Fresh food had to be available during the oviposition period. Without fresh food the females ceased ovipositing within two days of the last feed. Hatching occurred over a period of 10–18 days, depending on temperature. The newly-hatched larvae were placed on potted lucerne for rearing. The larvae immediately burrowed into the soil and fed on the root nodules. At room temperature the adults emerged from the soil 58–80 days after hatching.

The preferred hosts are lucerne (*Medicago sativa*) and burr medic (*M. denticulata*) but, in the laboratory and field, damage has been observed on white clover (*Trifolium repens*), ball clover (*T. glomeratum*), subterranean clover (*T. subterraneum*), black medic (*M. lupulina*) and spotted medic (*M. arabica*).

A pathogenic fungus *Beauveria bassiana* has been identified. It was attacking adults in cultures.

Clover Root Weevil (Amnemus spp.).—Larvae and adults severely damaged roots and foliage in subtropical legume pastures, *Glycine javanica* and *Desmodium* spp., in north coastal areas this year.

Oviposition in subtropical legumes was investigated, using *D. uncinatum* and *G. javanica* as test species. Egg-laying sites are not obvious in the commercial species of subtropical legumes. This contrasts with clovers. The clover petioles are hollow and the clover root weevil freely lays eggs in them. However, the frequency of large numbers of clover-root weevil in subtropical legume pastures suggests that the insect does go through its cycle in them without recourse to other legumes for oviposition.

Adult weevils held in cages with ladino clover laid freely in the clover petioles within two days, but given only fresh *D. uncinatum* or *G. javanica* did not lay at all during an exposure of five days. When dead legume and grass stalks were added, oviposition occurred in the hollow centres of both. This habit was confirmed by field observation—eggs were found in pastures in paspalum, *D. uncinatum* and *G. javanica* straws.

Although the subtropical legumes have solid woody stems and runners whilst green, and no central hollows suitable for egg-insertion, they produce a lot of dry matter that suits oviposition. Stolons and stems are continuously dying and being replaced. The pith cells of this dead material dry out and contract, leaving hollows in which eggs can be inserted. Furthermore, the species of grasses commonly grown in association with the subtropical legumes have hollow stems in the green state and also produce much straw in which egg laying can take place.

Of the three major species of subtropical legumes grown in north coastal areas, commercial strains of *D. uncinatum, D. intortum* and *G. javanica* are all attacked by the larvae and adults of clover root weevil, but Siratro is fairly resistant. The range of available strains and species of *Glycine, Desmodium* and Siratro is being tested for resistance to clover-root weevil larvae.

The study of clover-root weevil effect on yields of *G. javanica, Desmodium* spp. and Siratro is continuing. A dieldrin-treatment experiment was established this year. *G. javanica* or *D. uncinatum* pastures were surface-treated with dieldrin 1 lb per acre, to compare yields of untreated and treated pastures. The dieldrin-treatment appeared to have a toxic effect in two *G. javanica*-kikuyu grass pastures. Much higher rates of dieldrin had previously been used experimentally in north coast pastures without an observed deleterious effect.

Insecticides to replace dieldrin are being sought. Dieldrin controls clover-root weevil but because of residue-hazards to grazing stock was banned from use in pastures except as a sowing-treatment. DDT and lindane were tested last year and were ineffective—adding to an already long list of ineffectives. Laboratory and small field-plot screening of insecticides are proceeding, to screen out ineffective insecticides before large-scale field-testing. Currently, bromophos, birlane, and kepone are under large-scale field-trial; and methiadathion (supracide), previously tested against white-fringed weevil, is also being assessed.

Residual effect of rates of dieldrin drilled into the top soil before planting subtropical legumes is being investigated. This is to find levels that will permanently proof pastures against clover-root weevil attack.

It has previously been shown that subsurface (sod-seeder) application of dieldrin granules to established pastures at 1 lb per acre controls clover-root weevil as effectively as do surface application of emulsion and granule-formulations. There is now an experiment to determine whether dieldrin applied subsurface to an established pasture contaminates the milk and body-fat of cattle grazing the pasture for four weeks from three weeks after treatment. Preliminary analyses, using electron-capture gas-chromatography, have indicated low dieldrin-residues in butterfat and the body-fat.

As there is a "nil-tolerance" for dieldrin-residues in milk and body-fat, the sod-seeder application of dieldrin to established pastures seems unlikely to meet the current requirement.

Pest Survey of Tropical Pasture Legumes.—The survey of insects occurring on the main species of subtropical legumes continued. Under the dry summer conditions, adult clover-root weevil (*Amnemus quadrituberculatus*) and white-fringed weevil (*Graphognathus leucoloma*) caused severe foliage damage in many *Glycine javanica* and *Desmodium* spp. pastures.

The effects of feeding were especially severe in pastures heavily infested with larvae the previous winter, as plants already seriously weakened by larvae and lack of moisture were further weakened by the adults' preventing leaf growth. Damage was serious in the Bellinger-Nambucca districts and in parts of the Richmond-Tweed districts. Seedling-stands were destroyed in some cases. And established pastures were so severely denuded that the legumes gave little grazing over most of the summer. Carbaryl-treatment was needed in many cases to reduce foliage-damage.

Leaf-feeding by flea beetles (*Halticidae*) was common in north coastal areas on seedling *Desmodium* and Siratro and, to some extent, on *Glycine*. Growth was retarded and some plants were killed.

Fuller's rose weevil (*Asynonychus cervinus*) was prevalent in late summer in the Richmond-Tweed district on *Desmodium* spp. and caused severe foliage damage in some cases.

Severe foliage-injury by larvae of the leaf-roller (*Hedylepta diemenalis*) was recorded for the first time in established *Glycine*.

Armyworms and Cutworms (Noctuidae).—Severe outbreaks, on a wide range of crops, were reported from many areas. The outbreaks were sprayed with DDT or alternatives.

Outbreaks of *Persectana dyscrita* were reported during August-October from the southwest plains. Dryland pasture, wheat and barley were damaged.

In September, *Persectana ewingii* attacked young poplar plants as well as cereal crops at Tumut. Later in the year there were widespread outbreaks in the Southern Region, damaging a wide range of cereals.

By far the most widespread species in spring and early summer outbreaks in the Southern Region and in the Taree district was *Pseudaletia convecta.* Cereal crops and pastures were attacked. In the 1966 autumn the mid and far north coast areas also reported outbreaks of this species on pastures and cereal crops.

Severe infestations of *Spodoptera exempta* were present on the mid and north coast in autumn, in association with *P. convecta.* Mainly pastures were attacked, but with some damage to cereals. There were minor infestations of *S. mauritia, Agrostis ypsilon aneituma* and *S. littoralis* in association with the *S. exempta* outbreaks.

Biological studies of major armyworm species this year included investigations into distribution, host range, parasites, phase variation and life histories. A general picture of the distribution of each species has been determined and the limiting factors for each species are now being investigated. A survey of hosts for each species is proceeding. Specific host-preference has been found for each species except *P. convecta.* This has a wide host-range.

Over 200 specimens of parasites and predators were bred from armyworms collected from this year's outbreaks, and these await identification.

In preliminary studies of phase-variation with *S. exempta,* using solitary and crowded cultures, several interesting differences have been noted in colour forms, number of instars and oviposition.

A common breeding-technique, using maize seedlings, has been developed this year in laboratory studies of *P. dyscrita, P. ewingii* and *S. exempta* life-history. The length and description of all stages have been studied. Also, the effect of such factors as temperature and humidity has been investigated in relation to each stage.

The genera *Persectania* and *Pseudaletia* have been studied this year. Descriptions and setal maps for the various species have been prepared. Specimens in the Entomology Branch spirit-collection have been checked and, where necessary, re-allocated.

A trial to test alternatives to DDT against *P. dyscrita* was established at Tuppal Creek. Four insecticides—DDT, carbaryl (sevin), fenthion (lebaycid) and trichlorphon (dipterex) were each applied in September at three rates— ¼, ½, and 1 lb a.i. per acre. After two days some control was being achieved by each, but at three days the carbaryl was inferior. At the final counts, at five days, trichlorphon at ½ and 1 lb and fenthion and DDT at 1 lb a.i. per acre were best.

A further trial was established in March, 1966, at Warrell Creek to test DDT, carbaryl, tichlorphon, and diazinon. Rain right after spraying made the carbaryl and diazinon ineffective but the DDT and trichlorphon had enough time to dry and they gave good control—respectively at 1 lb and ½ lb a.i. per acre.

Blue Oat Mite (Penthaleus major) and *Red-legged Earth Mite* (Halotydeus destructor).—With the advent of cooler weather in the winter of 1965, earth-mite infestations quickly built up. Severe damage occurred in many areas. Spraying was extensive. Numbers declined in September and October in the warmer weather. By late October there was only an occasional report of the mite.

A trial to test alternatives to DDT against *P. major* infesting grasses in irrigated pastures was established in Muswellbrook. Eight insecticides—bidrin, fenitrothion (sumithion), thiocron, formothion (anthio), azinphos ethyl (gusathion A), chloropropylate (rospin), diazinon, and phenkapton were sprayed on to plots 30 yards square at ½ oz a.i. per acre in June, 1965. Good initial-kills were achieved by azinphos ethyl, diazinon, and bidrin at 36 hours after spraying, but after six weeks only azinphos ethyl was impressive.

Hatchings of red-legged earth mites were reported in April, 1966, in the Albury, Deniliquin, and Finley districts. Infestations were widespread in June, particularly on irrigated pastures in the Riverina.

A trial to test malathion LV against *H. destructor* in subterranean clover pasture was initiated in the 1965 winter at Kooba Station, Darlington Point.. The insecticide was applied by aircraft at three rates—2.0, 2.7, 4.0 oz per acre. After 45 days the 2.0 oz and 2.7 oz had broken down, but the 4.0 oz rate was still achieving some control.

A further trial in which malathion LV was aerially applied at 4.0 oz and 8 oz per acre was established at Marrar, near Wagga Wagga, in July, 1965. Results obtained from this and the Darlington Point work indicate that a rate less than 4.0 oz per acre would be ineffective for control of red-legged earth mite.

Another trial was done at Kooba Station, Darlington Point, in 1966 using malathion LV against *H. destructor*. The malathion LV was aerially sprayed at 4.0 oz per acre and compared with a standard imidan treatment applied by a ground rig. Results at seven days and 33 days indicated that the 4.0 oz of malathion LV was as good as the imidan treatment in controlling mites.

Wireworms (Elateridae).—Wireworms attacked and seriously thinned portions of a 600-acre wheat crop at Shepherds Siding, near Wagga, in June and July. These larvae were apparently there in early June when the crop was sown into land newly worked after being under improved pasture for several years. When observed in mid-August, larvae in substantial numbers were burrowing into the stem-base of small seedlings and killing many.

Two click-beetles, believed to be adult of this pest, were identified as *Crepidomenus* sp.

Rice Stem Borer (Bathytricha truncata).—In co-operation with Dr Henry Bess of the University of Hawaii, quantitative assessment of incidence of the rice stem-borer in the Murrumbidgee and Coleambally Irrigation Areas was concluded for the 1964–65 season.

Twenty-seven farms were sampled by removing plants from outside rows. Of the 9,127 stems examined, 436 (4.8 per cent) were attacked by the stem-borer. A small heavily-infested rice bay was surveyed to determine the silhouette effect. This showed that 26.5 per cent of the stems of rice in the four outside rows were attacked, ranging down to 2.7 per cent for plants in the centre of the bay. Much of the damage occurs before the shoot matures and is consequently unnoticed—only the more obvious stems, with empty heads, are detected.

Larvae were also found in *Echinochloa* spp., *Typha* spp., *Cyperus* spp., paspalum and water couch.

Cotton Insects.—Dry weather throughout the growing season again resulted in light insect-infestations in the Namoi district's cotton crops. The recommended pest-control measures were used by growers, generally with very satisfactory results.

Cowpea aphids (*Aphis craccivora*) caused malformed shoots in the earliest planted cotton crops. But by the end of October this pest's natural enemies, especially ladybird (*Coccinella repanda*) adults and larvae and hover fly (*Syrphidae*) larvae had greatly reduced it and the damage was of little significance. Some growers applied phorate, a systemic insecticide, at sowing. They applied it as granules, through special applicators geared to their cotton planters, and prevented infestation.

Late in October at Narrabri, a field trial was established to evaluate planting-time treatment with the systemics—disulfoton, phorate, cyanamid 43064, aphidan and UC 21149 as granules, and seed treatments with disulfoton, formothion and dimethoate. No aphid-colonies developed in the untreated plots, so insecticidal values could not be compared. But no treatment harmed germination or seedling establishment.

A small-scale field test at Myall Vale showed that spraying the seedlings with thismeton 0.025 per cent a.i., trithion 0.05 per cent, dimethoate 0.03 per cent, formothion 0.04 per cent, dibrom 0.1 per cent, or amiphos 0.04 per cent, gave 100 per cent mortality of aphids within twenty-four hours. But dimethoate caused an important level of leaf burn.

Common bollworm (*Heliothis punctigera*) activity was again heaviest at the time of maximum bud and flower production. Repeat DDT sprayings at 1 lb p.p.i. per acre, at five-day intervals in some crops, were needed throughout January and until about mid-February to protect against loss of early boll-set.

Rough bollworms (*Earias huegeli*) were of little significance. This was probably due to three factors: (*a*) the drought's restriction of growth of bladder ketmia, the insect's main alternative host; (*b*) the early ripening of many crops following successful protection of the first bolls from early *Heliothis* attack; and (*c*) growers' maintenance of a fortnightly spray schedule with endrin 4 oz a.i. per acre.

Field-collected larvae which pupated in May and early June, 1965, had all emerged as adults by the end of July. This confirmed that *Earias* has no diapause in its life cycle; that development must continue during the cold months, a time when host plants are scarce.

Spider mites (*Tetranychus ludeni* and *T. urticae*) appeared in cotton crops late in January and miticides were incorporated into the DDT-endrin sprays on one and in some cases two occasions. Demeton-S-methyl 4 oz a.i. per acre and ethion at 12 oz. a.i. per acre were the treatments mostly used by growers who obtained very good control. A Wee Waa field trial of various miticidal sprays showed these two treatments and also S.D. 9129 (Shell Chemicals) at 2 oz and bidrin at 4 oz a.i. per acre to give good control, whilst UC 20047 at 12 oz, SD 8211 at 12 oz and UC 19786 at 12 oz a.i. per acre were not satisfactory.

Tobacco looper (*Plusia argentifera*) was recorded as a pest of cotton for the first time in N.S.W. It heavily infested crops where fortnightly endrin spray schedules had not been maintained. Foliage damage was notable, especially in the more backward crops, as the caterpillars fed on leaf-undersides. In field trials, schedules of DDT-toxaphene, S.D. 9129 and E.C. 382 (Shell Chemicals) most effectively prevented caterpillar development. DDT-endrin also was satisfactory. And S.D. 9129 8 oz and mevinphos 7½ oz a.i. per acre were the best knock-down sprays. Growers also obtained good knock-downs with dibrom 16 oz and methyl parathion 8 oz a.i. per acre. A fungus, *Entomophthora* sp., infected and killed most of the caterpillars by the end of March.

FRUIT TREE PESTS

Spider Mites (Tetranychus spp.).—Two-spotted mite (*Tetranychus urticae*) persisted as a major problem of pome and stone fruit in the Murrumbidgee Irrigation Areas. The overwintering mites sheltered beneath leaf litter between peach trees, and under leaf litter on the crotches and to a lesser extent other tree parts. Heavy, late-winter rains caused the mites sheltering in irrigation furrows to disappear. Some overwintering forms began feeding and egg-laying on skeleton weed, capeweed and other weeds in early August on favourable days.

Seven different materials were applied in late winter, either once or twice, to eliminate overwintering mites from the tree. Each tree was banded with sticky banding-material (ostico) to prevent re-invasion. The treatments did not seem successful, but possibly this was due to ineffective banding.

In another experiment on canning-peach trees, weeds were checked by chemicals and by cultivation from the end of winter onwards. Miticides were used to eliminate the winter population. In midsummer only a light population had developed on the worst of the trees. In the weed-controlled area 10 per cent of the leaves were infested, while the area without weed-control had twice as many leaves infested and twice the population of two-spotted mites.

Cylindrical sticky-traps mounted on an artificial tree in peach, pear, and apple orchards were used to determine whether mites were dispersed through the air. Very small numbers were trapped. They could reach the target areas only through the air, but whether they were flicked from moving branches or were blown from or floated off foliage is not clear.

The main period of active-feeding forms was in late January and in February, under heatwave conditions. Predatory coccinellid and lacewing larvae and adults were detected; also predatory mites and thrips.

To stimulate spring and summer populations of predatory lacewings protein hydrolysate was applied to one-acre lots of peach trees on three farms, and on a one-acre pear-block on one of the farms. The protein hydrolysate was applied, either once or twice a week, from September onwards—about 4 oz of actual protein hydrolysate per acre at each application. Significant increases in lacewing egg-production were noted in November in all but one of the orchards.

By February the spider-mite population was reduced by 50 per cent in the twice-weekly treated orchard, compared with the unbaited area. In one orchard spider mites were not very numerous in either the unbaited or the baited area, but there was greater diversity of predator species in the baited than in the unbaited area. In the pear orchard there was no significant difference in spider-mite activity, but a reservoir of lacewings in an adjoining windbreak may have affected the result.

In a miticide-screening trial on an active population of the two-spotted mite at the end of January, the most effective materials were Bayer 49464 0.016 per cent (morestan), CIBA 8514 0.1 per cent, dicofol 0.04 per cent, and Union Carbide UC 20047A 1 lb per 100 gallons. Less effective was milbex 1 lb per 100 gallons. And indopol 3 per cent and ethion 0.05 per cent e.c. were very poor. In a pilot-trial on a declining population, dioxanthion (delnav) and I.C.I. 46566P, appeared promising.

At Orange the effect of winter treatments on control of two-spotted mite in Delicious apples was studied through the following treatments: (*a*) removal of shelter, plus spraying in winter, plus trunk banding; (*b*) as for (*a*), but no trunk banding; (*c*) no treatment. The spray treatments in (*a*) and (*b*) comprised lime sulphur 5–100 plus superior winter oil in late August, followed by binapacryl 0.5 per cent at early "pink".

Treatment (*a*) delayed mite build-up to an arbitrary level of 2.0 per leaf, by about 45 days as compared with no treatment. Where trees were not banded, build-up was delayed by about 35 days as compared with no treatment. Re-infestation of trees of treatment (*a*) resulted from the very low number of mites which survived the winter-spring treatment.

In another experiment at Orange, duplicated in two separate blocks, mite-incidence throughout the season was studied on sprayed and unsprayed trees.

In the unsprayed trees, infestation started to build up in early November in the inner-lower portions of the trees. By the end of November it had spread about half way up the trees, still in the inner sections. During December, the great bulk of infestation remained in the interior of the lower halves of the trees. By the end of December, mites were in the inner topmost sections and some movement to the outsides had begun. In the first half of January, infestation spread very rapidly upwards and outwards. By the end of the third week of January all parts of the tree were uniformly heavily-infested.

On trees receiving binapacryl applications, mite populations were of course low. A movement of mites to less-infested tree-parts was noted some weeks after spray application, as the acaricide-effect diminished. But very few mites were ever found in the outsides of well-sprayed trees. Some concentration of mites in the topmost inner sections of the trees remains unexplained. It could not have been due to lack of spray-coverage there.

Two comparative acaricidal-trials were done at Orange. In one trial best results were given by UC 20047A 0.075 per cent and dicofol 0.03 per cent. Three applications of each of these materials gave very good control for the season. Binapacryl 0.05 per cent was slightly less effective, with C8514 (CIBA) 0.05 per cent and oxythioquinox 0.0125 per cent somewhat less effective still. Indifferent results were given by chloropropylate 0.02 per cent and by milbex 0.0375 per cent. Disappointing results were given also by tetradifon 0.02 per cent, following poor performance in the same test area in the previous season and in the other trial. There is strong indication that resistance to this miticide is developing. Also, vamidothion 0.05 per cent gave poor results, indicating organophosphorus resistance in the block.

In the other trial, dicofol 0.03 per cent was outstandingly effective. Only two applications for the season were required. Also very effective was a formulated mixture of tetradifon 0.01 per cent and dicofol (PR1204) 0.0175 per cent. Binapacryl 0.05 per cent was satisfactory, though somewhat less effective than the aforementioned two miticides; but tetradifon 0.02 per cent gave poor results.

The application-methods of a number of leading growers in the Orange district were surveyed during March. The results will require a good deal of analysis. But, where large dense-trees were involved, no grower believed that automatic equipment was capable of a fully effective job. One grower who has had a difficult assignment in his large dense-trees claims good results by night-spraying, using only one side of his airblast machine and driving very close to the tree-row.

Oriental Fruit Moth (Cydia molesta).—The main peak-catches of Oriental fruit moth in lure-pots were at mid-November, end of December, late January, and in the first ten days of March in the Murrumbidgee Irrigation Area. Particularly high figures for late December reflected the rainy period early in that month, favouring for survival.

Dried Fruit Beetles (Carpophilus spp.).—Syrup lure-pots were maintained in three M.I.A. peach orchards. The beetles were trapped in highest numbers from mid-October through to the end of November. Catches were low during the apricot harvest, December. They increased gradually and substantially in January to reach another peak in early February before the peach harvest. Overall, the insect would not be considered especially abundant in the 1965–66 season.

Red Scale (Aonidiella aurantii).—The 1964–65 Merungle Hill, M.I.A., trial of single-spray treatments in February has been assessed. Control was good with each of the materials used, but the crop and the infestation levels were too low for the results to be definitive.

The materials were: dimethoate 0.025 per cent w.p. plus white oil 1/100; ethion 6 per cent-in-oil at 1 in 100; ethion 4 per cent-in-oil at 1 in 100; formothion 0.05 per cent e.c. plus white oil 1 in 100; fenitrothion (sumithion) 0.05 per cent plus white oil 1/100; and malathion 103 per cent concentrate at 0.1 per cent plus white oil 1/100, and at 0.15 per cent plus white oil 1/100. The malathion-concentrate formulation caused some fruit-blemish.

In a pilot-trial at Yanco, methiadathion (supracide) 0.03 per cent w.p. plus white oil 1/100 and Mobil carbamate (MCA 600) 0.05 per cent w.p. plus white oil 1/100 were not promising; whilst mercabam 6 per cent-in-oil at 1/100 gave adequate scale-control but caused some fruit-blemish.

In 1965–66 the treatments under trial at Merungle Hill as single sprays applied at the end of February were dimethoate 0.025 per cent plus white oil 1/100, ethion 6 per cent-in-oil at 1/100, formothion 0.05 per cent e.c. plus white oil 1/100, formothion 0.025 per cent plus white oil 1/100, fenitrothion 0.05 per cent w.p. plus white oil 1/100, ethoate-methyl (fitios) 0.025 per cent w.p. plus white oil 1/100, azinphos 0.05 per cent w.p. plus white oil 1/100 and malathion 97 per cent concentrate at 0.1 per cent plus white oil 1/100 and 0.15 per cent plus white oil 1/100. Results have not yet been assessed.

In another pilot-trial at Yanco, ethoate-methyl 4 per cent-in-oil 1/100, carbamult 5 per cent-in-oil at 1/100, bromophos 0.05 per cent plus white oil 1/100, and B.P. and Caltex white oils at 1/50 were used in April. The ethoate-methyl and carbamult treatments caused fruit-blemish. Scale-control has not yet been assessed.

White Wax Scale (Ceroplastes destructor).—Final assessments of the 1964–65 spraying trial at Kulnura showed excellent control by carbaryl at 0.05 per cent plus white oil 1/100 and 0.1 per cent plus white oil 1/100, when used at standard timing (Jan. 7). In later applications, up to January 28, carbaryl 0.1 per cent plus white oil 1/400 was even more effective. Carbaryl at 0.05 per cent plus white oil 1/400 and 0.025 per cent plus white oil 1/100, malathion 103 per cent concentrate at 0.13 per cent plus white oil 1/100 and white oil 1/50 on January 7 were less effective, but still satisfactory.

Final assessments in the 1964–65 spraying trial at Narara showed excellent control by carbaryl 0.05 per cent plus white oil 1/100 at standard timing (December 22) or 2½ weeks or 4 weeks later, with many scales protected by peak- or dome-wax development at the last date. No improvement in control was obtained by carbaryl 0.1 per cent plus white oil 1/100 at the later dates. Carbaryl 0.05 per cent plus white oil 1/400, methiadathion (supracide) 0.05 per cent plus white oil and white oil 1/50 on December 22 were less effective, but still satisfactory. Mobil carbamate (MCA 600) 0.05 per cent w.p. plus white oil 1/100 on December 22 was not promising. Mobil fruit-dip oil (mainly ethyl oleate) was used in pilot tests on January 20 and was promising at 1 in 40 dilution but much less effective at 1 in 80. The carbaryl sprays stimulated purple-scale development later in the season.

In the 1965–66 spraying trials at Kulnura and Narara, carbaryl 0.05 per cent plus white oil 1/100 was used with good results at standard-timing and two and four weeks later, with many scales settled on the stems and protected by wax development at the last date. Also effective, against larvae on the leaves, were carbamult 0.05 per cent plus white oil 1/100, carbamult 5 per cent-in-oil at 1/100, and white oil 1/50 sprays at standard-timing dates.

Brown Olive Scale (Saissetia oleae).—Carbaryl 0.05 per cent w.p. plus white oil 1/100 gave very good results in a small trial at Somersby. It was used a little late after hatching, against a population mainly of larvae about ⅛ inch long.

Excellent results were observed after grower-use of this spray against a heavy infestation at Cornwallis. It was used a little early, about a fortnight before full hatching.

The trial of protein hydrolysate application to stimulate lacewing-fly populations for biological control of brown scales was repeated at Dareton. Increased numbers of lacewing stages were counted on the trees receiving the food supplement. But no effect on the brown-scale infestation could be assessed.

Citrus Gall Wasp (Bruchophagus fellis).—Experiments on Eureka lemon trees at Oxford Falls were continued. Infestation was too low to determine significant difference between spray treatments applied to mature trees in the spring for protection against the new generation of wasps.

Other trials included spray and soil treatments on mature and nursery trees, and trunk injection, with bidrin. Results have not yet been assessed.

EDB fumigation as a method of disinfesting newly-dug nursery trees was not fully effective at dose rates up to 24 oz EDB/1,000 cu ft for one hour and 16 oz EDB/1,000 cu ft for two hours at 70° F in August/September/October. Higher doses would be likely to damage young trees severely.

Wasps causing galling on the native trees, *Eremocitrus glauca,* at Narromine have been identified as the citrus gall wasp. This was shown by taxonomic determination and by their ability to infest and gall rough lemon. The parasite, *Epimegastigmus brevivalvus,* was present in trace proportions.

Gall wasp was seen in trace infestation in Gilgandra home gardens and in heavy infestation in some Dubbo home gardens. These are some of the first records of gall wasp in western areas.

Although gall wasp has been found in the Gosford district, no infestation has yet been established in Gosford or Wyong commercial orchards.

Stem End Blemishing of Citrus (*Thrips?*).—Blemishing of citrus fruits was severe in some lower Murray orchards. The most frequent blemish was a flat scurfing at the stem end. Infestation of the new green fruits, from post-bloom to November, by a previously unknown thrips, is suspected as the cause. Thrips specimens are being identified.

A common blemish of oranges in the lower Murray and the Murrumbidgee Irrigation Areas was a furrow-mark around the stem-end, caused by very small larva of light-brown apple-moth feeding under the sepals on the skin of the new green fruit. Windrubs, tree-hopper injury, and furrow-marks from large larvae of the light-brown apple-moth were also frequent.

Macadamia Leaf Miner (Acrocercops chionosema).—Young leaves of macadamia were heavily infested in early spring in the Tweed district. Destruction of the upper leaf tissue was very damaging to young plants.

The insect's life history and habits are being studied. Head-capsule measurements suggest that there are six larval instars; three being passed in the mines and three in the blisters. No alternative host of macadamia leaf-miner has been found, but local botanically related species of trees are being investigated.

Passion Vine Hopper (Scolypopa australis).—Two consignments of the hopper eggs containing a parasitic scelionid wasp, from privet at Matcham, were sent in March to the N.Z. Department of Scientific and Industrial Research, Auckland, for biological control investigations.

Apple Root Weevil (Perperus sp.).—At Batlow, in August, 1963, an experiment was initiated to show whether injury by apple root weevil larvae causes die-back in apple trees. No significant growth difference has yet appeared in the comparison of trees in soil from which the weevils have been eliminated and the trees in an adjacent infested area. The treated area was again dieldrin sprayed in late September, 1965, to attempt to keep it free from weevil infestation for another twelve months.

A severe and widespread die-back of apples trees was noted at Orange early in the season. Larvae of white-fringed weevil, *Graphognathus leucoloma,* and of an unidentified species of weevil, were numerous in November—adjacent to damaged roots of apple trees showing severe die-back. From late November to early April observations were maintained in three seriously affected blocks. On one site, the one where numerous white-fringed weevil larvae were seen in November, numerous adults appeared in January and fed on the sparse herbage. Many adults of the weevil *Desiantha* sp. were also present on the herbage here in January, February, and March. No weevil was observed at the second site, and at the third site only one *Perperus* sp. adult was on ground cover in December-January.

Pinhole Borers (Xyleborus solidus).—A disorder in occasional apple trees was investigated to determine whether one of the pinhole borers, *Xyleborus solidus* is responsible. The disorder results in the rapid collapse and death of limbs or of entire small trees soon after growth starts in early spring—after seeming quite healthy the previous season. The pinhole borer was found not to cause the disorder. It merely infests trees which have become moribund.

Queensland Fruit-fly (Dacus (s.) tryoni).—In the very dry conditions of most of the year, fruit-fly incidence was low. An exception was a section of Narromine.

No large overwintering fruit-fly population developed. Commercial control was readily obtained in most orchards.

A survey of the fruit flies in north coastal areas was begun. Male, Cue, and ammonia-lure traps were set out in fruit areas in the Tweed, Brunswick, and Richmond River districts, and collections made of cultivated and wild fruits.

Male-lure traps consistently yielded *Dacus* (*s.*) *tryoni*, *Strumeta humeralis*, and *Dacus absonifacies* and small numbers of *S. bryoniae* and *D. signatifrons*. Flies which differed from *D. tryoni* only in the intensity of black coloration on the thorax, were also taken in male-lure traps and were presumably *S. melas*.

Cue-lures yielded only *D. tryoni*, *S. humeralis*, and *D. absonifacies*.

Ammonia-lures yielded *D. tryoni*, *S. cacuminata*, *Dirioxa pornia*, and *S. bancroftii* and small numbers of *Austrodacus cucumis*, *S. bryoniae*, and *S. humeralis*.

A Mediterranean fruit-fly trap yielded single speciments of *D. tryoni* and *S. humeralis*.

D. tryoni was bred from *Passiflora foetida*, *Ficus stephanocarpa*, *F. macrophylla*, *Davidsonia pruriens*, *Cyphomandra betacea*, *Cryptocarya rigida*, *Cudrania javanensis*, papaw, and, three times, from ripe bananas on unharvested bunches in the Tweed district; also from a green banana on a ripe bunch from Coff's Harbour, and from grapes at Mullumbimby. At Coff's Harbour, also, the unusual record of *D. tryoni* being bred from a ripe banana on a bunch still hanging, and of *Afrodacus jarvisi* from a banana that had fallen from the bunch on to the ground—the first record of *A. jarvisi* bred from banana.

D. pornia was bred from ivory wood (*Siphonodon australe*), Kyogle. *A. cucumis* was bred from pumpkin, cultivated fig, and wild plum, at Murwillumbah, and *S. cacuminata* was frequently bred from wild tobacco (*Solanum auriculatum*). *S. endiandrae* was bred from *Endriandra globosa*, Tweed district.

Queensland fruit-flies were not detected in the Murrumbidgee Irrigation Area nor in the adjoining towns of Narrandera and Hillston, where the fruit-fly suppression scheme continues to operate with regular applications of malathion and protein hydrolysate. The grids of male-killer lures have been renewed and maintained in each town and on farms.

Two fruit-flies were trapped in Hay at the end of the fruit season, and this followed the detection in December and February of two locations where several fruit had fruit-fly maggots. One of these places was well outside the town-treatment area, where mist-baiting with protein hydrolysate is practised and supplemented by a permanent grid of male-killer lures.

EDB fumigation studies with lemons, mandarins, and grapefruit were continued. Larval mortality experiments with artificially infested Eureka lemons fumigated with 14 oz or 18 oz EDB/1,000 cu ft at 70° F killed totals of 11,059 larvae by 14-oz dose and 10,260 by 18-oz dose, with no survivors. Reasonable evidence to warrant recommendation of EDB fumigation of lemons at dose schedules standard for oranges has been obtained.

Survey-type trials for rind-injury to Ellendale mandarins by EDB fumigation were done in July and early August on early, mid, and late-season fruit. With the early and mid-season fruit, rind injury was insignificant at 70° F. at doses up to 17 oz/1,000 cu ft on most but not all lines of fruit. At 60° F., slight susceptibility to rind injury was apparent at doses from 14 to 23 oz/1,000 cu ft—and some lines of fruit were more susceptible than others. With the late-season fruit, rind injury was negligible at 70° F. with doses up to 17 oz/1,000 cu ft and, at 60° F., with doses up to 23 oz/1,000 cu ft.

Survey-type trials for rind injury to Marsh grapefruit by EDB fumigation showed no injury to early-picked (May) fruit at 70° F. with doses up to 14 oz/1,000 cu ft or late-picked (October) fruit at 70° F. with doses up to 18 oz/1,000 cu ft. These results are at variance with 1963 season findings.

Evidence on suitability of EDB fumigation at dose-schedules which are standard for oranges, as a fruit-fly commodity-treatment for mandarins and lemons, was summarized (J. A. Seberry and J. G. Gellatley, May, 1966) for the use of the secretary of the technical committee in preparing a submission to New Zealand—seeking entry for certain varieties of mandarins and lemons after EDB fumigation.

Final results of the 1964–65 series of trials for disinfestation of Queensland fruit-fly in artificially-infested pears held at 33° F. for 14 days (including 7 hours pre-cooling) were 144,555 fruit-fly individuals treated, with four surviving (25,022 eggs, 0 survivors; 35,216 young larvae, 1 survivor; 55,717 old larvae, 3 survivors; 28,600 pupae, 0 survivors).

Techniques of cage-infestation and egg-implantation were developed for artificial infestation of bananas with fruit-fly eggs, and development of larvae in the fruits. Ethylene-ripening after infestation was necessary for best development of larvae, but there was some development in green, fairly hard bananas which had not been ethylene-ripened.

The effect of the ripening gases, ethylene and coal gas, on the immature stages of Queensland fruit-fly infesting banana fruit, was investigated at Murwillumbah. Neither gas, as used commercially for ripening bananas in sealed chambers, had any controlling effect on fruit-fly larvae or eggs.

Sixty-six samples of boxthorn (*Lycium lorridum*) berries were received during the year from Tamworth (37), Richmond (7), Caringbah (5), Kyeemagh (5), Wyalong (3), Sans Souci (3), Wellington (1), Dubbo (1), Parkes (1), Young (1), Dolls Point (1), and Ramsgate (1). Two specimens of Queensland fruit-fly emerged on 14th September from a Caringbah sample and this is the earliest record of breeding them out. They had not previously been bred from boxthorn berries before December. Other insects bred were *Drosophila melanogaster* (in large numbers from Tamworth and other areas), *Lamprolonchaea brouniana* (in large numbers, especially November-February, from various localities), *Niditinea fuscipunctella* (Tamworth, and some other areas), *Epiphyas postvittana* (Tamworth), *Pyralis farinalis* (numerous during March/April from various localities), *Sceliodes cordalis* (Tamworth), and *Heliothis punctigera* (Tamworth—first record).

STORED PRODUCT PESTS

Wheat Pests.—Examination of samples from export-wheat shipments, principally those to mainland China and the U.S.S.R., commenced in March, 1964, continued until the last shipments for the 1964–65 season in November, 1965. Of 103 shipment-samples examined in 1965, only 9 (8.7 per cent) contained living insects at the first sieving. Thirty-six contained no insects, and the rest contained dead insects. In 1964, insects emerged on incubation from 97 per cent of the samples, while in 1965 insects emerged from 76 per cent of the samples. The samples examined in 1965 contained about one-tenth of the number of grain insect pests found in 1964, both before and after incubation.

The overall reduction of infestation of samples, compared with 1963–64 season, appeared to be correlated with the application of malathion protectant-spray to wheat on intake at all bulk storages during the 1964–65 harvest.

The main species found in the samples were the rice weevil, *Sitophilus oryzae*, the lesser grain borer, *Rhyzopertha dominica*, the saw-toothed grain beetle, *Oryzaephilus surinamensis*, and flour beetles, *Tribolium* sp.; *R. dominica* was the dominant survivor after incubation. Emerged *S. oryzae* or other insects were usually dead at the time of examination.

In a trial at Billimari silo, commenced in December, 1964, the treatment fenitrothion 5 p.p.m. and 2.5 p.p.m., malathion 12 p.p.m., and control, were compared. No infestation was observed until 14 months after the start of the experiment. Insects were then found in the control bin. Two months later, saw-toothed grain beetles, *O. surinamensis*, were numerous on the surface and present at all depths sampled in the control bin. Some contamination of the control bin with malathion (about 1 p.p.m.) had been noted eight months after the trial started. There was very light breeding of lesser grain borer, *R. dominica*, in samples from the fenitrothion treatments, and the control, but none in the malathion sample, taken for laboratory bio-assay studies 14 months after the start of the trial.

A trial at Grenfell and Garema silos, started in December, 1965, compared the treatments fenitrothion 6 p.p.m. and bromophos 12 p.p.m. with malathion 12 p.p.m. as wheat-protectants. Four months later, living lesser-grain borers, *R. dominica*, were found in the bromophos treatment at both silos. But the other treatments remained uninfested. Significant breeding of *R. dominica* occurred in bromophos-treated wheat in laboratory bio-assay studies, even in samples taken immediately after treatment.

A trial of dust-protectants in wheat, replicated four times in 44 gallon drums at Condobolin, started in May, 1965, was sampled at first at 2-monthly and then later at 3-monthly intervals during the year. Insect-infestation was first evident in the untreated wheat nine months after the start. At this time there were living flour beetles, *Tribolium* spp., and saw-toothed grain beetles, *O. surinamensis*, in all four control replicates. One replicate of the carbaryl 10 p.p.m. treatment contained two living *T. confusum* at this sampling.

One year after treatment, *Tribolium* spp. were numerous in three of the four carbaryl-treated replicates. *R. dominica* was found in one of the bromophos 6 p.p.m. replicates. A few

Tribolium spp. were present in synergized pyrethrin-treated (1.7 p.p.m.) wheat. Malathion 10 p.p.m., fenitrothion 2.5 p.p.m. and 5 p.p.m., and diazinon 4 p.p.m.-treated wheat were free from insect infestation. The untreated wheat at this stage was heavily infested with *R. dominica, Tribolium* spp. and *O. surinamensis*. Bio-assay of samples with *R. dominica, Tribolium* spp., *S. oryzae* and *O. surinamensis* had earlier indicated that malathion gave better protection from these insects than any of the other materials.

Bromophos in particular was quite ineffective against *R. dominica* infestation, while carbaryl was very effective against this insect and ineffective against *S. oryzae* and *Tribolium* spp. Moderate numbers of *R. dominica* bred in fenitrothion-treated wheat sampled four months after the trial was commenced. *S. oryzae* and *Tribolium* spp. survived and bred in pyrethrum-treated samples.

The effectiveness of finely-ground magnesite mined at Thuddungra as a grain-protectant was tested by bio-assay in the laboratory with *S. oryzae, S. granarius* and *R. dominica.*

After incubation for ten weeks at 80° F and 55 per cent R.H., there was complete mortality and no breeding of *S. oryzae* and *S. granarius* in magnesite-treated wheat and only slight emergence of *R. dominica* (all the introduced adults had died), compared with development of heavy infestation of all three species in untreated control wheat.

During incubation for an additional four months, there was further slight emergence of *R. dominica* in magnesite-treated wheat. It appeared that *R. dominica* would persist despite the magnesite treatment. After twelve months under the accelerated breeding conditions of the constant temperature room, *R. dominica* had completely destroyed a 500 gm sample of magnesite-dusted wheat.

Maize Pests.—A field survey to determine the degree of infestation of maturing cobs by stored-product insects, and the distribution of the major pest species, was done during May in north and south coast districts. Random samples were taken from six properties in the Moruya-Bega area, from nine properties around Grafton, three near Casino, three near Tabulam, three near Kyogle and four around Lismore.

On the south coast the Angoumois grain moth *Sitotroga cerealella* was found inside the husk cover of a number of cobs and some tip grain was infested.

On the north coast the maize weevil *Sitophilus zeamais* was numerous in a small percentage of the cobs sampled. Its occurrence was not correlated with damage to or incompleteness of the husk cover. Numerous *S. cerealella* were found in samples from an early planted (October, 1965) crop north of Kyogle. Isolated grains infested by this insect were seen in only two other north coast samples. The samples are being held to incubate immature infestation.

The trial of protectants for husked maize on the cob, started at Grafton in August, 1964, ended in May, 1966. Insect-infestation was slow to develop, but at sampling nine and twelve months after application, it was evident that 2 lb of malathion 1 per cent dust per 18 cubic feet of cobs was giving the best protection. Malathion dust 1 lb, and malathion 25 per cent wettable powder, ½ oz and 1 oz, applied as sprays, appeared only slightly less effective. Synergized-pyrethrum treatments—2½ lb of 0.1 per cent pyrethrum dust and 0.6 fl oz of 6 per cent pyrethrum emulsion concentrate—gave no apparent protection from infestation.

Each treatment had ceased to be effective eighteen months after application. *Sitophilus zeamais, S. oryzae* and *Sitotroga cerealella* were found in samples taken right after treatment, and they increased gradually as the trial progressed. In the later stages, *Tribolium castaneum* and *Cryptolestes* sp. occurred in samples; and eighteen months after the start the moths *Plodia interpunctella* and *Cadra cautella* were numerous. When the maize was being shovelled out in May, *Tenebroides mauritanicus* was noted in the badly infested grain.

The cob-protectant trial conducted at Dondigalong, west of Kempsey, with similar treatments, was sampled finally in August, 1965, twelve months after the start. This maize was free from insect infestation when the treatments were applied and there was only slight infestation by *Sitophilus zeamais, S. oryzae, Sitotroga cerealella* and *Tribolium* sp. when the trial was sampled nine months later. After twelve months, sufficient infestation had developed in the pyrethrum treatments and the control to indicate that 2 lb malathion 1 per cent dust per 18 cubic feet was giving complete protection while the other malathion dust and spray treatments were slightly less effective.

Wheat infested with *S. oryzae, R. dominica, O. surinamensis, S. cerealella, T. confusum, Cryptolestes* sp., *P. interpunctella* and *Carpophilus dimidiatus,* and maize grain and unhusked maize cobs infested with *S. zeamais, S. oryzae, S. cerealella, Tribolium* spp. and *P. interpunctella,* stored with and without 10 ml methylated spirits per 5-gallon drum, were examined in February after twelve months' storage. All drums were found to be infested. It was concluded that treatment with alcohol in this way was not effective against insect pests of stored grain, nor did sealing the drums with 4/1,000 polythene sheeting have any lasting effect.

Storage trials of unhusked maize cobs, husked cobs, whole grain and hammermilled grain were started at Grafton and at East Kempsey in August, 1964. The trial in bags at East Kempsey was sampled finally in February, 1966, eighteen months after the start. The trial with larger quantities in boxes at Grafton has been retained and was last sampled in May, twenty-one months after the start. Both trials demonstrated the effectiveness of hammermilling in killing insects present in the grain.

Infestations of *S. zeamais, S. oryzae* and *Tribolium* sp. developed in hammermilled maize in both trials during storage, but *Cryptolestes* sp. occurred only in the Grafton trial. There it was most numerous nine-twelve months after hammermilling and thereafter it declined.

The hammermilled maize remained in good condition despite insect infestation. At Grafton the weight-loss per bushel in hammermilled grain during eighteen months, storage was about half that in shelled grain and unhusked cobs. Bushel-weight measurement of the hammermilled whole cobs from Kempsey gave variable results because of the shredded husk present, but indicated that there was only slight, if any, loss of weight per bushel during storage.

The husked cobs in both trials had less insect infestation than the other forms of maize up to nine months after storage started. After this, at Grafton the amount of infestation in samples of husked and unhusked cob grain and shelled grain evened out; at Kempsey the unhusked cobs remained more heavily infested than the husked cobs until the trial ended but lost less weight per bushel than both husked cobs and shelled grain—and the eventual loss of weight per bushel in husked cobs was greater than that in unhusked cobs and shelled grain.

These small-scale trials have indicated that where feed-maize is to be stored without an insecticide-protectant and is at some stage hammermilled prior to use, it would keep better if hammermilled prior to storage—provided it is dry enough to prevent mould development. Taking both trials into account, the overall impression is that unhusked maize cobs are less susceptible to insect-infestation in long-term storage than either husked cobs or shelled grain. The amount of damage suffered by unhusked cobs in storage probably depends mainly on the severity of field-infestation, while the presence of complete husk-cover in storage would be expected to reduce cross-infestation of the cobs.

The storage characteristics of 1,600 tons of maize in bulk storage at Lane Cove were investigated in June and July, 1965. This large bulk of maize from southern Queensland (Clifton, in particular) and northern New South Wales had been stored since May, 1965, without insecticide-protectant and was in excellent condition. Temperatures taken with a Radson probe in June ranged from 45–58° F at 14 ft from 44–57° F at 8 ft, and from 43–55° F at 5 ft. Examination of 2 oz samples from six points close to the bottom of the bulk (15 ft depth) in July showed insignificant insect-activity. The only insects found were one maize weevil, *S. zeamais,* one *Tribolium* larva and one *Carpophilus* sp., all alive.

A cargo of 40,000 bushels of maize imported in bulk from Iowa, U.S.A., on the *s.s. Pinebank* was inspected in quarantine in November to ensure that it was free from Khapra beetle, *Trogoderma granarium.* Samples were taken by probe throughout the maize to a depth of 15 ft in the hold. The surface of the maize was lightly infested, probably from rice and soya bean-meal cargo which had been loaded on top of it. But the bulk of the maize was free of insect-infestation.

Larvae of the tropical warehouse moth *Cadra cautella* were numerous in mouldy maize on the surface around the walls of the hold where there were residues of split milled-rice and soya bean meal. Adult *C. cautella* and Indian meal moth *Plodia interpunctella* were numerous resting on the walls. Flat grain beetle *Cryptolestes* sp. was numerous in samples of maize from the surface near the walls. Other living insects found on the surface were hairy fungus beetle *Typhaea stercorea,* tobacco beetle *Lasioderma serricorne,* psocids and mites. A few maize weevils *Sitophilus zeamais* were also found.

The maize was also inspected as it was trucked into a bulk shed at Lane Cove, but no serious insect-infestation was found.

Oat Pests.—An investigation to determine the importance of insect-infestation in stored oats was started in July, 1965, when four 2,000 bushel silos of oats at Condobolin were sampled at the bagging-spouts.

One silo held oats stored for 18 months and fumigated in the summer because of insect-infestation. Samples from 12 bags drawn from the two bagging-spouts contained living rice-weevil, *Sitophilus oryzae,* rust-red flour beetle, *Trifolium castaneum,* saw-toothed grain beetle, *Oryzaephilus surinamensis* and long-headed flour beetle, *Latheticus oryzae,* and numerous dead *S. oryzae, Tribolium* spp., *O. surinamensis,* and lesser grain borer, *Rhyzopertha dominica.*

The other three silos held oats stored for eight months and not fumigated. Samples taken direct from the bagging-spouts containing living and dead *Tribolium castaneum* and *T. confusum* and living *O. surinamensis.*

At Enfield, in August, oats stored in bulk bins and silos were sampled. A large bin of oats from Victoria sampled by probe was lightly infested with *S. oryzae, T. castaneum, O. surinamensis,* and flat grain beetle *Cryptolestes* sp. Oats in a railway waggon from Cootamundra contained also numerous *Latheticus oryzae* and dead *R. dominica.* One silo of oats from Cootamundra was sampled with a probe and found free from infestation. The oats is not held in storage for more than six weeks at this mill.

The samples from the bin of oats were held in a constant-temperature room for five months. Severe infestation of *S. oryzae* and *R. dominica* was in some samples taken on, or within 5 ft of, the surface after this incubation period, while samples from the bulk of the oats—to depths of 15 ft at the sides and 18 ft at the centre—contained few insects.

Two 1,000-bushel tanks of oats were surface-sampled at Condobolin in September and again with a probe and from bagging-spouts nearly two months later—in October. These were Avon oats stored since November, 1963, and carbon bisulphide-fumigated in February, 1965. The oats was surface-infested with *T. castaneum* and *T. confusum, O. surinamensis, Cryptolestes* sp., foreign grain beetle, *Ahasverus advena,* and psocids, and contained numerous dead *S. oryzae* and one *L. oryzae.* The predatory anthocorid *Xylocoris flavipes* was numerous on the surface of the oats in both tanks and dead parasitic-wasps were also found.

Most of the insects found at depth in the second sampling were dead, and, besides the species named in the preceding paragraph, a single specimen of dead *R. dominica* and of the hairy fungus beetle *Typhaea stercorea* were found. The predominant species of flour beetle in the samples from these tanks was *T. castaneum.*

It is concluded that it would be advisable to apply an insecticide-protectant when placing oats in storage, to prevent the appreciable damage caused by the types of infestation described.

Soya Bean-Meal Insects.—Insects infesting bulk soya bean-meal imported from the U.S.A. by ship in January and February included the black larder-beetle *Dermestes ater,* red-legged ham beetle, *Necrobia rufipes,* mechant grain-beetle *Oryzaephilus mercator,* foreign grain-beetle *Ahasverus advena,* rust-red flour-beetle *Tribolium castaneum,* tobacco beetle *Lasioderma serricorne,* flat grain-beetle *Cryptolestes* sp., fungus beetles *Typhaea stercorea* and *Mycetophagus quardriguttatus,* and predatory bug *Xylocoris flavipes;* also *Coninomus constrictus* (Lathrydiidae) and *Conotelus stenoides* (Nitidulidae).

Surface samples in June from another shipment from Houston, Texas, contained rice weevil *Sitophilus oryzae,* Indian meal-moth *Plodia interpunctella,* and *Ephestia* sp. as well as other insects.

Cross-infestation in shipping appeared to be the main source of insect-contamination in each instance.

Oilseed Pests.—Samples of linseed, safflower seed and sesame seed were inoculated in April, 1965, with *S. oryzae, R. dominica, O. surinamensis* and *T. confusum* to test susceptibility to insect-infestation. Examination in July showed that the insects did not infest linseed, but that *O. surinamensis* and *T. confusum* were able to breed in safflower and sesame seed. The sample of safflower seed was already infested with *O. surinamensis* and *Cryptolestes* sp., before the test.

Drug-store Beetle (Stegobium paniceum).—Large bag-stacks of crude argol, a rock-like residue obtained from wine vats, infested with the drug-store beetle, *Stegobium paniceum,* were inspected at Parramatta in November. An attempt was made in the laboratory to infest pieces of argol, pure cream of tartar, calcium tartarate, and calcium citrate. All the adults introduced died without breeding, whereas they bred readily in crushed-wheat medium. Close examination of the argol revealed that only impure pieces containing grape seeds, pieces of stem and other foreign matter, were attacked.

VEGETABLE PESTS

Potato Aphids (Myzus persicae, Macrosiphum euphorbiae).—The overwintering sites of *Myzus persicae* and *Macrosiphum euphorbiae,* the two principal vectors of potato virus, were under systematic observation at Orange through the winter and early spring of 1965.

Myzus persicae, the main vector, was numerous throughout the winter in all developmental stages—including alatae—on a wide range of herbaceous host-plants in such sheltered positions as occur in home gardens and parts of orchards. *M. euphorbiae* was much less numerous, and relatively few alate forms of it were observed.

Very few aphids were found in exposed situations, or around most potato fields. Generally, little in the way of suitable host plants was present in such situations. Where there were such plants, field peas for example, they were colonized by a few aphids. It seems probable that, where suitable host plants are present, anholocyclic overwintering of *M. persicae* is of more significance than the holocyclic method in the Orange district.

Alate forms of both species are available to fly to and colonize potato plants as soon as these are above ground in early October.

A trial, using one acre of the Kurrel variety in which the seed carried a minimal amount of leaf-roll and rugose mosaic infection, was carried out at Orange. This was to determine whether certified-seed potatoes can be grown in the Orange district provided the recommended measures are carried out. The measures are: use of first-class seed; early roguing of crops; maintaining the crop free of aphids in the first eight weeks of its growth; and destruction of the tops in early autumn.

Four applications of demeton-S-methyl 4 oz a.i. per acre, were made. This programme kept the crop virtually aphis-free until eight weeks after emergence. Then light infestations developed, with both vector species present. It was evident that an interval of 14 days between applications could not be exceeded. The crop was "rogued" on three occasions. On no occasion was any aphid-borne virus disease detected. This indicated that the seed material was extremely virus-free.

The crop was subjected to considerable invasion by alate *M. persicae* from early April until the tops were destroyed by a pulverizer in mid-April. A very small proportion of plants was not completely destroyed. These remained infested by incoming alate-aphids and by their apterous progeny for a period of about two weeks longer than the rest of the crop.

Potato Moth (Phthorimaea operculella).—Insecticide-screening against potato moth in tomatoes was conducted at Terranora. The moth is apparently resistant to DDT in the Tweed River district. The following insecticides were tested—0.05 per cent DDT, 0.05 per cent azinphos ethyl, 0.05 per cent endosulfan, 0.05 per cent bidrin, 0.025 per cent fenitrothion plus 0.025 per cent dichlorvos, 0.05 per cent DDT plus 0.05 per cent azinphos ethyl, and 0.1 per cent methiadathion. Potato-moth infestation was low and little fruit-injury occurred in any treatment. Azinphos ethyl and endosulfan gave better control than the other insecticides. DDT, azinphos ethyl plus DDT, endosulfan and methiadathion controlled a heavy infestation of *Heliothis armigera,* but the other insecticides were ineffective.

Tomato Pests.—Equally efficient control of *Heliothis* caterpillar was demonstrated with DDT 0.05 per cent high-volume spraying and mist-application of DDT—at both the previously used standard rate of 3½ fl oz 25 per cent e.c. and half that rate. But general low incidence of *Heliothis* reduced the confidence that might be placed in the low rate's results. The standard rate of misting gave DDT residues which were greater on leaves at half-plant height, comparable on stems at half-plant height, and less on leaves and stems at the tops of the plant and on fruits, than were those from high-volume spraying. And the misting-rate required only half as much DDT as high-volume spraying.

DDT residues on marketable fruits seven days after the last application were highest for 0.05 per cent DDT high-volume spraying at 2.2 p.p.m. (whole fruit basis).

ANIMAL PESTS

Sheep Blowfly (Lucilia cuprina).—Late in 1965, laboratory work established a change in response of field strains of sheep blowflies, *Lucilia cuprina,* to organophosphorus (O.P.) chemicals registered for prevention of flystrike.

A survey has revealed that the problem is present in field-populations of the blowfly throughout the major sheep-districts of New South Wales. Comparative-tests on susceptible and field-strains showed that the alteration in response is from three to five times above normal. The following insecticides are involved—diazinon, fenthion ethyl (lucijet), fenchlorphos (nankor) and dichlofenthion (nemacide).

Implants were made with larvae of susceptible and O.P.-tolerant strains, on sheep jetted with registered O.P. flystrike-preventives, to get an indication of the practical significance of the development of O.P.-tolerance in the blowfly. There were consistent differences in length of time between treatment of the sheep and the establishment of artificial strikes. O.P.-tolerant larvae formed flystrikes sooner than larvae of susceptible strains. However, the differences in protective-period were not great. It would seem that O.P. chemicals can still be used to combat flystrike, provided jetting is thorough.

Because of the drought, there was insufficient flystrike in field experiments to provide for conclusions on the future value of O.P. chemicals for flystrike-prevention or to assess the merit of butacarb—a possible alternative.

DOMESTIC PESTS

Argentine Ants (Iridomyrmex humilis).—Four new areas of infestation—total area about 64 acres—were reported. Thus, since Argentine ants were first reported in Sydney in April, 1950, there have been 269 known infestation-areas—totalling over 6,000 acres.

Progress in spraying was satisfactory during the periods from 1st July, 1965, to 12th January, 1966, and from 9th May to 30th June, 1966, due to favourable weather. Twenty "new" areas of infestation, including three that were not completed in the previous year, were sprayed; and three previously-sprayed areas were spot-sprayed following the re-discovery of Argentine ants during the survey mentioned later. A total of 596 acres was sprayed, using 53,125 gallons of 0.75 per cent dieldrin and 946 gallons of 2 per cent chlordane. Only two areas of infestation remained to be sprayed, to complete all known areas. And these should be done within July, 1966.

From 13th January to 6th May, 1966, fifty-seven areas of infestation sprayed prior to 1960 were surveyed. Argentine ants were found in two of them, and had obviously been re-introduced after the treatment. Another area was infested by extension of a new area of infestation. Argentine ants had also been found in three of the 145 areas of infestation sprayed prior to 1960. These had been surveyed in 1963–64. The ants had obviously been re-introduced to two of them. How the third became re-infested is in doubt.

In summary: of the total 202 areas of infestation sprayed prior to 1960 in the experimental eradication campaign, only five have shown the presence of Argentine ants 5–13 years after spraying—and the ants had been re-introduced into four if not all of the five. The project has satisfactorily demonstrated the practicability of eradication of Argentine ants.

Seven areas of infestation sprayed since 1962 were also surveyed. Argentine ants were found persisting in two situations in one of these seven areas. A total of 3,228 properties were surveyed this year in the 64 infestations covering 1,295 acres, and the ants were found in 42 of the 3,228 properties.

Cockroaches (Blattella germanica *and* Periplanete americana).—The animal-house of a Sydney medical research centre treated in February, 1965, with the sorptive dust dri die 67 containing 95.3 per cent silica aerogel and 4.7 per cent ammonium fluosilicate was examined finally in July, 1965—five months after treatment. Only five German cockroach *Blattella germanica* adults were flushed from hiding places—a most satisfactory improvement on the heavy infestation present prior to treatment.

A Riverstone meat works was visited in July to inspect places where dri die 67 had been applied. The dust had been effective in dry situations. It was predictably ineffective around skin-steaming rooms, where the American cockroach *Periplaneta americana* abounded.

Silverfish (Ctenolepisma longicaudata).—An exploratory test of insecticide powders for silverfish control was conducted in April. Two formulations of sorptive dust (silica aerogel plus 1 per cent synergized pyrethrum) and silica aerogel plus 0.1 per cent synergized pyrethum and 4.7 per cent ammonium fluosilicate) were compared with boric acid powder and a proprietary powder containing boric acid, magnesium carbonate, and 0.1 per cent synergized pyrethrum.

The proprietary powder produced knockdown in 10 minutes, but some of the silverfish lay twitching on their backs for more than three days before death. Each of the sorptive-dust treatments achieved knockdown within one hour and all the silverfish died within 18 hours of the start of the test. The boric acid powder did not produce knockdown, and some of the silverfish on this treatment took more than seven days to die.

The Division of Science Services library at Rydalmere was sprayed with 0.3 per cent pyrethrins and 3 per cent piperonyl butoxide in kerosene in March to control silverfish. Satisfactory atomization was obtained with a paint spray gun at 40 p.s.i. This produced a mist that filled the room for more than an hour after treatment. No staining of the books occurred. One living silverfish was found in a locked book-carrying box after treatment. No silverfish problem has re-occurred four months after treatment.

SYSTEMATIC ENTOMOLOGY STUDIES

Distribution and Taxonomy of Aphids.—The aphid-trapping programmes were continued. Thousands of specimens were examined and identified this year. These included specimens trapped on a farm at Bathurst, aphids trapped during study of cereal yellow dwarf virus, aphids trapped in connection with banana aphid studies on the Tweed River, and aphids trapped in a short study of pea-virus vectors in the central tablelands.

There were two new records: *Anomalaphis* sp., a native species from Western Australia; and *Tinocallis ulmiparvifoliae,* an introduced species. The latter was actually recorded years ago but not represented in the collection.

The Insect Collection.—This year 3,113 insects were incorporated into The Collection, together with 35 specimens of spirit-material. Some 4,797 insects were mounted and 279 remounted.

The following Groups were re-arranged, or subject of improvements during the year: cotton insects; quarantine insects; the systematic collection of the Lepidoptera, of the families Hepialidae; Microlepidoptera, Noctuidae, Anthelidae, and Sphingidae.

Study of the Curculionidae.—Some 961 specimens were added to the collection of weevils. They are new mounts, in the following sub-families: Brachyderinae (163), Sitoninae (138), Otiorhynchinae (9), Eremninae (36), Leptopinae (409), Cylindrorrhinae (23), Rhytirrhininae (33), Amycterinae (58), Gonipterinae (40), Cleoninae (17), Erirrhininae (1), Aterpinae (25), and Apioninae (39).

Chemistry Branch

CEREAL SECTION

The wheat crop for 1965–66 was the lowest since 1957–58. Some 27.4 million bushels was delivered into the New South Wales silo system, from an estimated total crop of 39 million bushels. The previous harvest had resulted in 144.1 million bushels delivered at New South Wales or Victorian border stations from a total of 151.5 million bushels.

F.a.q. and Silo Survey.—Because of the small crop only one f.a.q. standard was set—the Southwestern f.a.q. It was composite of silos all south of Dubbo. In the drought conditions there was considerable haying off, and resultant low yields and low bushel weights. These conditions were conducive to high protein and record figures were achieved.

The highest protein-figure recorded since silo surveys have been conducted was obtained at Wirega silo near Grenfell. Grain protein was 15.8 per cent. A number of silos exceeded 14 per cent protein. These included Goolgowi, Brundah, Goonumbla, Alectown West, Pullabooka, Bribbaree, Weedallion, Burcher, Calleen, Tabbita, and Rankin's Springs.

Apart from segregated premium-receivals for biscuit wheat, the milling industry found it difficult to get supplies of lower-protein wheat for softer-type flours. That situation rarely occurs in this State.

Only a small pocket of country between Henty, Oaklands and Culcairn provided some wheat in the 10 per cent to 11 per cent protein range.

Uniform Quality Testing.—The Uniform Quality Testing Committee was convened late in the year, having tested material distributed after the harvest. A number of pairs, of Heron and a new crossbred K.F. Heron, had been distributed to the collaborating laboratories in industry and scientific institutions. This was in furtherance of the decision made in the previous year, to test the new crossbred for a further season.

The quality committee agreed that K.F. Heron equalled but was not an improvement on Heron. Whilst not opposing K.F. Heron's release the committee felt that greater improvement should be sought with softer-type wheats suitable for production in the south.

Collaboration with other Bodies and Institutions.—A wide range of collaboration and assistance occurred. Examples of assistance given are: to the University College, Wollongong, in work on bulk-handling and the flow of granular materials; to the Commonwealth Department of Supply relative to surveys on atomic fall-out; to the Queensland Department of Primary Industries and to the Wheat Research Foundation, Narrabri, for training of staff; to the local flour-milling industry, where there has been increased inquiry about wheat and flour-quality problems, besides collaborative analytical testing.

Cereal Chemistry Conference.—The Annual Cereal Chemistry Conference was held at Terrigal, New South Wales. Two members of the staff attended and a paper on "Biscuit Wheat Production under Irrigation" was presented.

Wheatgrowers' Residential School.—The Cereal Chemist lectured at a residential school for wheatgrowers conducted by the University of New England. Two hundred growers attended. Two lectures were presented: "Quality Assessment in Wheat, and the Influence of Quality on Price" and "Wheat in the Australian Economy and World Trade".

New Equipment.—A new direct-reading balance for use with large samples was received. This greatly increased the output in the dough-physics laboratory.

Royal Agricultural Society Wheat Championships.—Officers of the Cereal Chemistry Section, in association with a representative of the New South Wales Flour Millers Council, acted as Judges and Stewards for the open-class wheat entries at the 1966 Sydney Royal Show. Due to the record levels of protein content, there were some outstanding entries which gave magnificent results in the bakehouse.

The three Champion wheats, Festiguay, Falcon and Heron, were all bred by the Department.

Premium Wheats.—The Department was represented by the Cereal Chemist at a meeting convened by the Premium Wheat Growers Association to consider which wheat varieties would be received into the bulk-premium system operating in the north and west in the following season.

Two lines, White Hopps and Millitire No. 1, were excluded from the list of acceptable varieties. The new variety Gamut was added to the list.

It was also decided to issue a warning that the varieties Gamenya and Mengavi would shortly be removed from the list with a view to obtaining a bulk-pool of three or four varieties having similar grain-appearance and similar strong-flour character.

The Department presented strong evidence for inclusion of Festiguay in the pool. Comparisons of over 50 trials in three seasons had shown that Festiguay always had a higher protein content than other leading varieties and, overall, was superior in baking-quality to Eureka, Gamenya, Mengavi and Mendos and only slightly inferior to Gabo. Despite the evidence, the meeting deferred making a decision on inclusion of this strong variety.

Because of the small crop, individual premium-sales were under two million bushels, as against more than four million bushels in the previous season. Some of the prices paid would constitute a record. Parcels of Gamenya, Mendos, Spica, Mengavi and Koda exceeded $1 premium in excess of the f.a.q. price. These high prices were paid early in the season and included considerable business conducted in the north near the Queensland border.

Falcon headed the premium-list with regard to quantity sold but did not command a very high average price per bushel. The sales were late enough in the harvest period for the overall high protein-level of the available crop to be well known, and Falcon does not have all the desirable blending-characteristics of the other recommended premium-varieties.

Central West Wheats.—Examination of data from the work conducted in the central western wheat-belt during the 1963–64 harvest was completed. The results were published in the *Agricultural Gazette of N.S.W.* The work showed that during the 1963–64 harvest considerable mottled wheat was received at many of the silos. The mottling was confined to hard varieties, and associated with a weighted-mean decrease of 2.6 per cent in grain protein-content. Prevalence of mottling in the central west is an important wheat-quality problem. It has wide implications, particularly in relation to wheat marketing.

Biscuit Wheats.—The study of biscuit-quality of soft-wheat varieties and of factors influencing it is continuing. Results so far have shown that Heron and K.F. Heron tend to be too strong for biscuit making, and that the newly introduced North American varieties Chile 1B and Mexico 120 have poor potential for it.

A paper on the results of this project was presented to the 15th Annual Conference of the Cereal Chemistry Division, Royal Agricultural Chemical Institute, in October, 1965.

Laboratory Output and Procedures.—Some 1,010 wheat, flour, and other grain samples were received; including 181 wheat samples from the Grain Elevators Board, 251 from plant breeders and 1/40th acre Departmental trials, and 45 samples for the Uniform Quality Testing. Of the remainder, 280 were wheat samples from farmers' variety trials conducted by district agronomists, 79 were oat and barley samples, and 174 included export samples, special samples as those from Division of Plant Industry trials, official f.a.q. samples, R.A.S. samples, collaborative-test samples from flour mills, and samples from the Soil Conservation Service, etc.

Samples experimentally milled totalled 1,064, including work late in 1965 on samples from the 1964–65 harvest.

Other laboratory determinations included: oven-moistures, 2,339; wheat and flour ashes, 418; and Kjeldahl proteins, 3,801.

Experimental baking output increased. The total of loaves baked was 2,953, as against 2,458 in the previous season. The increase was mainly through research into dough machinability of the currently recommended varieties, particularly those in the north and Queensland. Also, there was preliminary work on the effects on baking of the method of milling samples with the range of experimental mills available in cereal chemistry laboratories.

It was previously reported that good agreement was achieved on the common range of experimental mills when the resultant flours were baked. But that finding has not been confirmed in these laboratories. Further trials are being planned.

Certification of Export Wheat and Flour.—Only 32 wheat shipments were certified: 27 from Sydney and the 5 others from Newcastle. It was apparent in the winter that there would only be isolated sowings in the northwest, and an increasing demand there for wheat for stock feed as well as to maintain supplies for the flour mills in the area. Therefore, exports through Newcastle were curtailed in August, after only 52,000 tons (1.94 million bushels) had been shipped. Because of supplies on hand, and crop prospects in the southern half of the State, export through Sydney terminal was maintained till November. In the period July-November, 27 shipments to China and Russia were certified. These totalled 476,000 tons (17.8 million bushels).

Flour exports were at an all-time low level. For a considerable period there was a ban on export, to ensure sufficient wheat stocks on hand to meet local needs—including large quantities for stock feed.

Only 16 requests were received for export-quality certificates, and only four shipments exceeded 500 tons gross weight.

No action was needed under Commonwealth Export Regulations with regard to prohibition of export of under-quality flour.

Wheat Industry Research Council Grant—Wheat Grading.—Closer statistical analysis of survey results has shown a very significant relation (99 per cent confidence level) between grain protein content and the visual appearance of the grain. The relationship varies from year to year, but the overall relationship holds and is a sound basis for using the grain's visual appearance as an aid in segregation of wheat.

Some further data are in the hands of the biometricians, awaiting still more detailed analysis of this and various other relationships.

The final report has now proceeded through several drafts. Maps, graphs, and photographs to illustrate the report are being prepared in a form suitable for reproduction by the printer. The printed report should be available in the near future.

PESTICIDES SECTION

Dieldrin Residues in Dairy Cattle.—An experiment was conducted in association with Entomology Branch to investigate the dieldrin residues in dairy cattle grazing pastures sod-seeded with dieldrin granules at the rate of 1 lb a.i./acre.

Dairy cattle were grazed for four weeks, starting three weeks after application of the dieldrin, and milk samples were taken during this period. Two weeks after the last milk sample was taken the animals were slaughtered for body-fat residues analysis. Samples were analysed by electron-capture gas-chromatography. Maximum butterfat residues were about 0.5 p.p.m. Maximum body-fat residues were about 0.1 p.p.m.

Dieldrin Residues in Eggs.—Experiments are being conducted at Glenfield Veterinary Research Station and in the Division of Science Services, Rydalmere, to determine the degree of contamination of eggs through treatment of laying hens with dieldrin dust and emulsion formulations. Residues will be assessed by electron-capture gas-chromatography.

Mercury Residues on Fruit.—(*a*) Further mercury determinations were done on apples from trees which had received an eradicant spray of mercury in the previous autumn, but none during the growing season. During the year some twenty samples were analysed. In no case was any significant amount of mercury found.

(*b*) Mercury determinations were made on samples of apples which had received a number of mercury sprays, ranging from 0 to 4; applied in mid-October, early November, early December, and early January. The results were somewhat unexpected. The mercury found in the whole fruit was similar for two, three, and four spray applications, whereas a gradual increase in mercury content would have been expected. No explanation can be offered. Further samples will be prepared during the 1966–67 growing season for confirmatory analysis.

Azinphos and Carbaryl on Fruit: Residue Breakdown Rate in Cool Store (at about 37° F).—Results in these trials in 1964 were unsatisfactory, due to a poor sampling method. In 1965 an improved sampling method was used. But most of the samples had been too lightly sprayed for the purpose of this experiment. Therefore, such samples were dipped in the appropriate spray solution, to ensure a relatively high level of residues.

Sub-samples were analysed at approximate nine-week intervals. After 36 weeks in cool store, some 50 per cent of the azinphos residue and some 70 per cent of the carbaryl residue remained.

Diphenylamine in Apple Peel.—The method of Kennett (*Aust. Jour. of Agri. Res.* 1961, 12 No. 5, p. 834) has been used to determine diphenylamine in the peel of twelve samples of apples dipped in a solution of the superficial-scald control-agent, diphenylamine. The results were fairly uniform in the range 0.5 to 1.0 p.p.m., based on the weight of the whole fruit.

A few determinations were made also on the pulp, but no significant amount of diphenylamine was found there.

Salicylanilide Formulations for Banana-Dipping.—Formulations of salicylanilide used in dipping bananas to control blackend and squirter diseases were investigated in the laboratory and the field. The dipping is compulsory but there has been doubt whether some growers have dipped their fruit in a salicylanilide preparation as prescribed.

To assist fruit inspectors in checking consignments, the "field test" to detect salicylanilide deposits on the banana skin was improved. A quantitative analytical-method for laboratory use was also developed.

Cases of bananas were dipped under comparative field-conditions, in suspensions or solutions of commercial salicylanilide-formulations. This was to assess stability and efficiency. Analyses of the dipping-fluids and the bananas showed that the suspensions maintained their concentrations at a higher level and deposited more salicylanilide on the bananas. Division of Horticulture co-operated in this project.

Physico-chemical Studies of Pesticides.—The behaviour of several relatively insoluble pesticides (gamma-BHC, carbophenothion, coumaphos, diazinon, fenchlorphos, and malathion) solubilized in surface-active agent solutions has been examined. This was by *in vitro* dipping-experiments, with flour beetles (*Tribolium confusum*).

The surface-active agents alone, whilst being sorbed from solution by the insects, removed cuticular material. So did several common solvents. But the effects were not sufficient to explain changes in biological activity of the solubilized pesticides.

Biological response appeared to be determined by the rate of uptake of pesticide by the insect cuticle, the permeability of which was increased by the surface-active agent.

That conclusion is of relevance to many cattle- and sheep-dips where surface-active agents are used to emulsify the pesticide and to wet animal and insect surfaces.

Investigation of Sheep Dips.—Sheep dips for control of ecto-parasites were further investigated in collaboration with the Veterinary Research Station, Glenfield. Experiments with suspensions of finely divided sulphur were done to find an alternative to lime sulphur for control of itch mite (*Psorergates ovis*).

Lime sulphur is an excellent acaricide for this pest. But supplies are relatively expensive, and bulky to handle. Also, because of its alkalinity many other pesticides which might otherwise be mixed with it, to control a wider range of ecto-parasites, are adversely affected.

The "stripping rate" of the finely divided sulphur deposited on the animals was found to be relatively constant. Physico-chemical and biological tests are continuing.

Miscellaneous Analyses.—Considerable other work was done for other Branches and Divisions, by way of analyses of a wide range of agricultural and other commodities. This work was roughly in two categories, as follows.

(*a*) Detection and measurement of small amounts (residues) of pesticides, e.g., examination of plants for the presence of weedkillers, examination of bees for presence of poisons, investigation of dog-food for traces of rat poisons, analysis of cereal grains (wheat, oats, and millet) for presence of fungicides or insecticides, analysis of river water for pollution by agricultural pesticides, examination of bananas for presence of weedkillers, and of soils for traces of pesticides.

(*b*) Analysis of pesticides in formulations, e.g., examination of weedkillers and of white oils, for stability on storage, analysis of white oils to determine their suitability for winter or summer sprays, and identification of unknown liquids and solid pesticides.

Committees.—The Pesticides Chemistry Section was represented in the Specifications Committee of the Standards Association of Australia, and in the "Pesticide Residues in Food" Sub-committee of the National Health and Medical Research Council.

WATERS SECTION

Water Testing Services in Greater Demand.—Continuance of the drought conditions led to increased demand for the Department's Water Testing Services. Water from new sources located by extensive search-programmes, privately undertaken or by the W.C. and I.C. crash programme of bore-sinking have been submitted for urgent testing and advice on suitability for stock, irrigation, and domestic use.

Regional Water Testing Services.—In many cases testing was done at short notice by Regional extension officers, using locally-based electronic and chemical equipment to determine the merits of continuing bore sinking. In some cases landholders were saved considerable expense by the advice before they equipped for or proceeded with development of unsuitable bores, wells, etc. Similarly, cost-saving advice was given on management practices to allow use of marginal waters.

In the Northwestern Region (Gunnedah headquarters) 58 per cent of the waters tested were unsuitable for irrigation use because of high levels of total and residual alkali. A further 22 per cent were subject to crop-tolerance or amendment recommendations.

The Regional Water Testing equipment established in 1959 under a scheme of partial decentralization of the Department's science services function, has proved to be a very valuable and necessary factor in the provision of efficient extension advice on problems of irrigation and drainage.

The high demand for this service under drought conditions has, however, placed a heavy strain on Regional officers performing this function as well as the drought-inspired greater demand for their specific technical advice.

The total of water and soil samples tested by Regional officers for the year was 4,174, which followed 3,508 in 1964–65. At the headquarters laboratories, Rydalmere, the respective totals were 780 and 1,038.

Most of the soil samples tested in the Mid Coast and Hunter Region based on Maitland were from areas watered with moderately saline water. However, due to management practices and satisfactory drainage, only a few showed dangerous accumulations of salt. A day-by-day advisory service was maintained during a critical period in the salinity status of the tidal reaches of the lower Hunter, Paterson and Williams Rivers. These waters are used for crop-production and the service was invaluable in management control to prevent serious salt damage.

REGULATORY AND GENERAL CHEMISTRY

Examination of Stockfeeds.—Quality surveys of registered stockfeeds were continued in accordance with recently determined policy. Samples of a wide range of sheep, cattle, pig and poultry feeds were collected from mills at Wagga, Albury, Armidale, Tamworth and Dubbo. Appropriate action was taken where divergence from registered analyses was detected.

Increasing use of supplementary feedstuffs and concentrates, necessitated by the drought, resulted in a meat-meal quality survey. This revealed several cases of non-compliance with standards as registered under the Act.

There has been some concern over the increasing, undeclared use of non-protein nitrogen additives—such as urea—in registered sheep and cattle feeds.

Reports by Regional officers suggest that poor growth responses by stock in recent months may be due to incorporation of additional urea in place of animal or vegetable proteins. These have been in short supply in the drought. Legal action is contemplated in cases where urea has been found to exceed the prescribed standard. Work is proceeding in this field.

Progress has been made by the committee appointed to review and amend the Stock Foods and Medicines Act and regulations.

Trace Elements in Feedstuffs.—Using atomic-absorption techniques, analyses are being done in a comprehensive survey to establish mineral and trace element levels of Australian feedstuffs.

Over 100 samples of a wide variety of stockfeed ingredients of known origin are being analysed for calcium, magnesium, sodium, potassium, manganese, copper, zinc and iron contents. This is a joint project, in collaboration with Seven Hills Poultry Research Station.

Choline Requirements of Poultry.—A project to establish under Australian conditions recommended levels of choline in poultry diets has been commenced in collaboration with Seven Hills research staff. Feeding trials are proceeding at Seven Hills. Choline is an important vitamin in poultry nutrition. The outcome of this project should benefit the Australian poultry industry.

Butter Survey.—A quality survey of factory butter production involved analyses of 584 samples for salt and water. Some 58 per cent of the moisture figures and 14 per cent of the salt figures were outside the limits prescribed by the Dairy Industry Act.

This survey also involved bacterial studies of the butters. A report on this is included under Dairy Bacteriology, in the Biology Branch report.

Avocado Quality Research.—It has been established that the quality and degree of maturity of avocados can be most satisfactorily assessed by determining their oil content. Oil content increases as the fruit matures.

Some earlier analyses had been done for the Division of Horticulture, using standard but time-consuming chemical methods. To give fruit officers at Alstonville Tropical Fruit Research Station a rapid method of assessing oil content, a method based on refractive index of the oil in a suitable solvent is now being investigated.

PHYSICAL CHEMISTRY SECTION

Free Energy and Soil Potassium.—Last year's Report referred to consideration being given to the use of free-energy figures to measure the availability to plants of potassium in the soil.

This year, following a literature survey, work was initiated in this field and free-energy measurements have been made on some 200 soil samples from the potash research programme of the Chemistry Branch. The results are now being studied for correlations with other information obtained during glasshouse trials with these soils.

The trends of experimental curves indicate that these do follow the behaviour of the soils under cropping. Soils staff are awaiting with considerable interest the final conclusions.

Instrumentation.—Late in 1965 the advantages and practicability of using the Beckman spectrophotometer as a recording instrument in its application to the analytical work of the Chemistry Branch were investigated.

The Beckman spectrophotometer as used in the Chemistry Branch plays a dual role. It is of value both for optical density measurements in colorimetric methods of analysis and for flame-emission spectrometric methods. Because of the demands on this instrument it has seemed desirable to increase its capacity by converting to recorder-output. An adaptor has been assembled and wired into the instrument to permit the use of a potentiometric type of recorder.

Various commercially available recorders have been tested with the instrument. The experience has confirmed the advantages of recorder-output in increasing the capacity of the instrument and in improving its efficiency in other ways.

Atomic Absorption Spectroscopy.—About 200 determinations for calcium and magnesium in soil extracts were done for the Soil Section; also 600 determinations for potassium, and a few analyses for sodium, magnesium and calcium in 0.025 N barium chloride.

Near to 2,000 samples were analysed by the Plant Nutrition Section for calcium, magnesium, sodium, potassium, zinc, copper and manganese—using the atomic-absorption spectrophotometer. Rock-phosphate samples for the above seven elements were also analysed.

As foreshadowed in the 1964–65 Report, an automatic dispenser called a "Filamatic" has been purchased. It is now used to prepare all the dilutions for atomic absorption spectroscopy. One effect is a considerable saving of time.

A new atomizer and spray chamber was obtained for the burner on the atomic-absorption spectrophotometer. This has increased the sensitivity for most of the elements determined.

Fertilizers and Fertilizer-Base Materials.—Work continued on various sources of rock phosphate from Australian Fertilizers Limited. Some 224 samples from Nauru, Florida, Christmas Island, and Ocean Island have been analysed for trace elements on the Large Spectrograph. They have also been analysed on the atomic-absorption spectrophotometer for the major elements.

Some differences as between sources have been detected. These differences could have some nutritional significance. Glasshouse trials will test this significance.

Wood Ash Analyses.—Analyses of the pilot wood-ash samples have been completed, for trace and major elements. Glasshouse experiments have been conducted, using the various samples as fertilizers on heated and unheated soils. These experiments produced interesting results. Further work on wood ash is to be done, on a larger scale, in collaboration with the Forestry Commission.

PLANT NUTRITION SECTION

Statistics of Analyses.—The range and total of analyses increased. About 33,000 analyses were done by the section, as against 22,000 analyses in the previous year. The increase has been possible through modern instrumentation and increased experience.

Analyses of Cotton Petioles.—The first step in a programme to standardize nitrate-levels in cotton petioles has been completed.

In the 1965–66 season the Division of Plant Industry established seven rates-of-nitrogen trials on properties in the Narrabri district (rates of 0, 40, 80, 120, 160, and 200 lb of N per acre). Plants for these trials were sampled at at least four physiological stages: first squares, early flowering, first bolls and late bolls; and nitrate-nitrogen determinations were carried out on the petioles.

On first inspection the nitrate-nitrogen levels of the petioles in these trials were significantly lower than published levels for Arizona trials. These differences can be expected, as the Arizona trials were on sandy soils whereas the Narrabri trials are in general on heavy soils. It emphasizes the need to develop local standards, for local soils and conditions.

Currently the nitrate-nitrogen levels in the leaf, and nitrogen applications, are being related to the yield of cotton on each of the trials. The trials will continue for another two to three years, to develop the local standards.

Indications from the year's work are that nitrate-nitrogen levels should be about 2,000 to 3,000 p.p.m. in the petiole at flowering, and falling away sharply from flowering to harvest. It is desirable that the nitrogen levels cut out to ensure early maturity.

Banana Leaf Analyses.—A co-operative project with Division of Horticulture was initiated to study banana leaf analysis techniques, on a fertilizer trial at Alstonville Tropical Fruit Research Station. Monthly samples were submitted to the Chemistry Branch, to study: (i) the variation in N, P, K levels between plants on a uniform area; (ii) the variation in N, P, K levels on leaves of various age on individual plants; (iii) the variation of N, P, K levels associated with time of day.

Arrangements have been made to study the monthly variation of these nutrients also on standard plants.

Citrus Leaf Analyses, re Fertilizer Needs.—Thirty orchards in the four main citrus-growing areas of New South Wales have been surveyed for the second year in succession, co-operatively with Division of Horticulture. The main aim of the experiment has been to recommend, based on leaf analyses, fertilizer-applications to these test-orchards.

Results of these recommendations are then evaluated in succeeding years. N, P, K levels have been altered as little as possible, or not at all, in the second year. Remedial measures are taken in the event of trace elements being low.

There have been indications during this work that some previous N, P, K fertilizer-recommendations had been on the high side. An effort is being made to use these nutrients very conservatively and in correct balance.

Completion of the third year's work is expected to yield meaningful results. This is one of the first positive steps towards the possibility of a plant-analyses service for fruit growers.

Magnesium in Citrus.—Magnesium levels in citrus leaves in relation to tree health have been studied in the County of Cumberland, Gosford, and the Lower Murray districts in the past two years.

So far, a close relationship is indicated between magnesium levels in leaves showing symptoms and the general tree-health. The relationship also looks promising in respect of magnesium levels in spring-flush leaves and tree-health. The results are being compiled for publication.

Magnesium Spray-Response in Citrus.—Twelve field-trials have been prepared, to test on citrus the efficiency of magnesium nitrate sprays in correcting magnesium-deficiency symptoms. Many citrus workers have felt over the years that dolomite and magnesite soil-dressings have been slow and ineffective in correcting deficiencies.

In the current trials, magnesite soil-dressings at 5 lb–20 lb per citrus tree have not given any visual response in two years. Magnesium nitrate sprays on the other hand have almost completely corrected magnesium-deficiency, within 8–12 weeks of spraying. This significant response may be associated with magnesium-nitrate interaction.

Growers in the County of Cumberland, Gosford, and Lower Murray districts are now using the method.

Trace Elements in Rock Phosphate.—Regular samples of rock-phosphate and superphosphate have been sent to the Chemistry Branch by arrangement with Australian Fertilizers Ltd and Greenleaf Pty Ltd. The samples have been analysed for a wide range of trace elements, to check: (*a*) the variation between trace elements and individual shipments, and (*b*) variation of trace elements between sources of rock phosphate.

Previously, rock phosphate was imported from a constant source, viz., Nauru Island. The British Phosphate Commission, aiming to conserve rock-phosphate resources, directs shipments of rock phosphate to New South Wales from at least four different sources for the manufacture of superphosphate. The present sources are Nauru Island, Ocean Island, Christmas Island, and Florida.

The Chemistry Branch project has shown that, of all the trace elements, zinc seems to vary most in respect to source. Christmas Island samples contained about 90–100 p.p.m. zinc, whereas Nauru samples contained as much as 1,000 p.p.m. of zinc. The difference in these levels may well be significant to growers in correcting zinc deficiency and to experimenters who are testing for zinc deficiency.

The evidence is that research workers in trace-element experiments should use pure chemicals, or at least know the zinc level of the superphosphate being used.

"U.P.S.E.T." Trials.—Results in respect to phosphorus and sulphur levels in plant material have been compiled in the U.P.S.E.T. project over the last four or five years. These results are now being processed for publication.

Mostly there has been close relationship between phosphorus and sulphur content in plant material and yield. Published CSIRO results on pot and field trials have shown a correlation coefficient of the order of 0.9 between sulphur and plant yield.

The Chemistry Branch for the last decade has adopted critical levels based on early exploratory work in relation to phosphorus and sulphur levels of sub clover and lucerne, and been using these in advice to Departmental field officers.

The U.P.S.E.T. results are expected to further confirm the early work of the Chemistry Branch and the CSIRO results.

Sheep Growth-Rates Trial.—A co-operative trial was undertaken with the Division of Plant Industry at Hawkesbury Agricultural College, to study growth rates of sheep on single species of pasture. The differences in sheep growth-rates were recorded for various species.

To explain the differences, the Chemistry Branch did a wide range of analysis on pasture species—including ammonium-nitrogen, nitrate-nitrogen, non-protein nitrogen, carbohydrate, fibre, and crude-ash analyses. Some of the analyses were done on parts of the carcass as well as on the pasture species.

An attempt is now being made to relate chemical analyses of pasture species to the live-weight gains of animals grazed on them.

Evaluation of New Fertilizer Materials.—Fertilizer companies and associated organizations are constantly seeking advice on evaluation of new forms of fertilizers. This year several types of fertilizers have been pot- or field-tested.

Australian Coal Research submitted a coal product impregnated with nitrogen; Greenleaf Fertilizer Pty Ltd submitted a new gypsum and phosphorus type of fertilizer, and rock phosphate; Australian Fertilizers Ltd submitted samples of MAGAM; an engineering firm at Newcastle submitted a mixture of magnesium oxide and calcium oxide.

Zinc in Northwestern Maize.—Last summer large acreages of irrigated maize were planted in areas stretching from Quirindi to Moree for the first time. Reports of maize stunting, and specimens of affected plants, were received from northwestern agronomists.

These plants were examined visually and also analysed for a full range of plant nutrients. After the visual examination, zinc salts were sent to the agronomists. They noted responses within a week of application. Spray applications of zinc sulphate were timely and beneficial. Side dressings in the soil were ineffective. Zinc deficiency was later confirmed by plant analysis.

The northwestern areas affected with zinc deficiency in respect to maize were extensive. The zinc deficiency was probably a result of land grading and exposure of subsoil. Subsoils in the northwest generally contain large quantities of calcium carbonate or marl and have a high pH. Under such conditions zinc deficiency may be induced. Zinc deficiency has also been reported in high phosphate soils.

Plants affected by the zinc deficiency contained an average of 18 to 20 p.p.m., whilst unaffected plants usually contained more than 30 or 40 p.p.m. The dry weight of normal maize plants was about ten times the dry weight of affected plants. Total recovery of zinc from the affected plants as against recovery from the unaffected plants was strikingly low.

The observed symptoms were severe stunting, interveinal chlorosis or striping, shortened internodes, failures to mature, no tassel or cob formation, and ragged leaf-margin. Longitudinal sections of stems showed characteristic browning about the nodes. The older leaves which showed symptoms before spraying were still evident at the base of the plant even though later growth was normal following corrective treatment.

Some $500,000 worth of irrigation equipment and row-crop machinery were outlaid in the northwest last season for irrigated maize crops. The timely diagnosis and recommendations undoubtedly helped to save most crops.

Trials to test forms and rates of zinc compounds are planned for the 1966 spring.

Celery Quality.—The excellence of South Australian celery is generally accepted. Comparisons of analysis between South Australian celery and celery from Victoria and New South Wales are interesting:

	Cl %	N %	K %	Na %
South Australian ...... (cuts well)	6·8	1·18	6·0	2·48
Victorian .... (does not cut well)	3·94	1·13	6·6	0·69
Botany, N.S.W. .... (does not cut well)	3·5	4·0	2·46	0·9

Usually 1½ per cent chloride or 0.5 per cent sodium in plant material is sufficiently toxic to be lethal.

Tobacco has a capacity to take up large quantities of chloride and grow reasonably well although the quality of the tobacco from the point of view of smoking is impaired where much chloride is present in the leaf. Celery on the other hand appears to be unique. It is able to take up enormous quantities of chloride and sodium without apparent deleterious effect on quality. Significantly, the South Australian celery has such high chloride and sodium but is low in nitrogen. That combination or ratio of nutrients in most other plants would be lethal.

Peat Quality.—A Sydney nurseryman has located a peat deposit within 70 miles of Sydney. An estimate is that there are sufficient reserves to supply the Australian market for hundreds of years at the present rate of consumption. The deposit is close to rail.

Peat at present is imported from overseas countries and marketed for about $16 per bale. The imports cost Australia about half a million dollars annually. New South Wales consumption is about 75 per cent of the imported peat.

The peat is used largely by nurserymen and there is a big potential for its use by the home gardener.

Samples of the local and imported peats have been analysed and compared. Results of the analyses are as follows:

Peat	Loss of Ignition %	Cl %	N %	P %	Na %	B %	Moisture %	pH
3'	85	0·01	3·26	0·150	0·02	18·5	82·5	5·8
Imported	90	0·04	0·86	0·020	0·02	3·8	..	3·0
Kurnell	..	0·08	1·25	0·022	..	..	..	2·1
Mt Gambier ..	..	0·24	2·38	0·094	..	..	..	6·9

Agriculturists predict an expansion of the peat trade in Australia if the price is reasonable.

Copper Deficiency in Poplars.—Young poplar trees grown in a nursery at Buxton were stunted and the leaves showed cupping and blackened margins. Leaf analyses of recently matured leaves showed that these trees were low in copper. The trees when treated with copper sulphate were rejuvenated; growth was significantly stimulated and the leaf symptom was corrected. Copper sulphate is now normally incorporated in fertilizer recommendations for young poplars on this soil type.

Forestry Commission officers have since isolated a particular clone of poplars which is extremely sensitive to copper deficiency. It appears to be one of the best copper-indicator plants.

Selections from this clone could be very useful in diagnosis of copper deficiency.

Elemental-expression of Nutrients, and Review of Fertilizer Act.—In association with Legal officers and Division of Plant Industry, revising of the Fertilizer Act in accordance with modern developments in agriculture and the fertilizer industry is under consideration.

That all fertilizer constituents, particularly phosphorus and potash, be expressed as the elements instead of using the confusing and somewhat archaic terms, P_2O_5 and K_2O is proposed. This is a worldwide trend and being accepted into the fertilizer legislation of more and more countries.

Elemental-expression is almost uniformly used in analysis of plant samples, feeds, and most other agricultural analyses. But in the fertilizer field the change here has been slow. South Australia adopted elemental-expression several years ago. And when New South Wales proposed it at an Australian Agricultural Council Meeting in 1964, a recommendation was made for all States to apply elemental-expression of all nutrients in their legislation.

Another source of farmer-confusion is the lack of uniformity throughout the fertilizer industry in methods of denoting fertilizer-composition. Many fertilizers are designated by numbers. Each manufacturer has a different set, bearing no relationship to the nutrient content of the fertilizer. Thus, two mixtures with the same number, from different manufacturers, are usually quite unrelated. Other manufacturers name their product according to its N, P_2O_5 and K_2O content. Others add to the confusion by naming the fertilizer according to the proportions of superphosphate, sulphate of ammonia and muriate of potash used in its manufacture.

A uniform system of nomenclature is being drawn up, based ultimately on the N:P:K content of the fertilizer.

The importance of trace elements and sulphur is now well recognized. But over 30 years ago when the present Fertilizer Act was formulated only nitrogen, phosphorus and potassium were taken into account. Now it is recognized that in many parts of the State, sulphur is of far greater importance than potassium and that deficiencies of trace elements such as molybdenum can very seriously affect production over wide areas.

Accordingly consideration is being given to making the same fertilizer-legislation provisions for these elements as have formerly been made for nitrogen, phosphorus and potassium.

Modern methods of spreading, handling and transport of fertilizers—with special reference to bulk handling—are also to be taken into account in proposed new legislation.

Sulphur-fortified Superphosphate.—Sulphur-fortified superphosphate was developed in the late 1950's, to supply sulphur to pastures where sulphur was the main deficiency but where some phosphorus might also be needed. In the interim it has become a major source of sulphur for pastures.

In the past year 1½ million acres have been topdressed, with over 60,000 tons of "S.F. 30" or "S.F. 50" sulphur-fortified superphosphate. Confidence in the fertilizer has developed largely as a result of improvements in the availability of sulphur from this fertilizer. Initially most of the elemental-sulphur component of "S.F. super" was coarse and very slowly available.

Through earlier findings in this branch, manufacturing methods have been modified to a new wet-mix method to increase the surface/mass ratio of elemental sulphur in "S.F. super".

A number of samples of "S.F. super" produced by the new method have now been tested to determine the effectiveness of the new process in increasing the surface/mass ratio and consequently the availability of elemental-sulphur in the fertilizer. Preliminary results indicate a definite improvement.

The total amount passing a 60-mesh sieve ranges from 62 per cent to 78 per cent of the elemental-sulphur present. In the original mechanically-mixed sulphur-fortified superphosphate only 25 per cent of elemental-sulphur passed a 60-mesh sieve.

The improvement is especially significant as previous work at Tia, and glasshouse-investigations, showed that elemental-sulphur in the –60 and –100 fractions were the main fractions releasing available sulphur in the first couple of years.

Fertilizer manufacturers are aware of the desirability of having a minimum of coarse material and are also aware of the unfavourable impression given by large lumps left on the surface. But they are in some ways restricted by manufacturing difficulties, and by Civil Aviation regulations. The latter impose restrictions on inflammability which is in turn influenced by fineness of the elemental-sulphur fraction. A good deal of improvement has been made by melting the sulphur into the mix.

The detailed findings have been brought to the attention of the manufacturers. They have indicated intention to work towards further improvement.

SOILS SECTION

Soil-phosphorus Studies; Pasture Soils.—A further 33 soil samples from the Uniform Pasture Series Extension Trials (U.P.S.E.T.) were tested for "easily soluble" forms of soil phosphorus. The soil-test values from about 80 "rates of superphosphate" trials are being correlated with yield-values.

North Coast Superphosphate Trials; Grafton.—Three hundred soil samples from new trial-sites sown during the year to Ladino white clover and the summer legume *Lotononis bainesii* were tested for "Bray No. 1" soluble-phosphorus.

Soil-test values for these unimproved pasture soils are very low. They indicate severe shortage of plant-available soil-phosphorus. This is confirmed by the dramatic response of the legumes to superphosphate dressings.

No plant samples were received for analysis, because of the drought conditions.

South Coast Pasture "Phosphorus and Potash" trials.—Seven hundred soil samples from nine trial sites in the Berry-Moss Vale-Nowra area were tested for "Bray No. 1" soluble-phosphorus. These "initial" samples were taken before the first fertilizer application.

The range of soil types includes red basaltic soils, shale soils, and soils from sandstone. Soil-phosphorus test values varied from as low as 10 p.p.m. to a very high 200 p.p.m.

Northern Tablelands; Superphosphate Trials.—Some 300 soil samples from a "rates of superphosphate x stocking rate (wethers)" trial at Shannon Vale Nutrition Station were tested for "Bray No. 1" soluble-phosphorus. Soil-test values generally increased with increasing amount of superphosphate applied. The variation in stocking rate did not appear to affect the level of Bray soluble-phosphorus.

In two of the three replications, there was an indication of a build-up of available phosphorus at one end of the paddock. This is probably the outcome of sheep "camps". A large amount of faecal phosphorus would have been deposited and trampled into the surface soil.

The trial is scheduled to continue for a few more years.

Soil-phosphorus Studies in Wheat Soils.—Twenty-nine wheat fertilizer trials (nitrogen and phosphorus factorial) were sown in the central west in 1965 as part of the wheat-nutrition research programme. The extreme drought caused a severe moisture-stress from which the plants did not recover. There were therefore no yield figures or grain samples available for correlation with the soil-phosphorus test-values.

Both the acid Bray No. 1 and the alkaline Olsen (16-hour shaking period) methods were used to characterize the soil-phosphorus status of the trial sites. By the Bray method, 22 of the 29 trial sites tested as low in soil-phosphorus status, five tested as medium and two tested as high status. By the Olsen method the figures were respectively 18, 9 and two.

In the 1966 season soil samples from 41 trial sites in the Central West were taken for analysis. This total includes 12 trials sown by the Cowra unit, operating for the first time.

Previous trials have indicated that on soils rated "low" for soil-phosphorus, 1½ cwt superphosphate per acre is the optimum rate for a "typical" season. But, in a dry year such as 1965, there would be only enough soil moisture to enable ½ cwt super/acre to benefit the crop.

Soil-Potassium; Glasshouse-Millet Studies.—This trial was ended in December, 1965, by water restrictions. Soil analyses have been completed, and yields and relationship between yield and the various methods of analysis have been statistically analysed. Some interesting correlations have been obtained. These show promise of ability to predict a response. Analyses of plant material are proceeding.

A paper on the chemical methods used and developed has been submitted for publication. Another, relating the yield data to soil analysis, is in preparation.

Potash in U.P.S.E.T. and Potato Trials.—Samples from these series of trials have been analysed for potassium to assist in determination of the limiting-values for these crops.

Potash in South Coast Fertilizer Trials.—These factorial trials, with four rates of P and K, were started during the 1965 spring. They were laid out and soil-sampled. Analyses of these samples and of plant material from the plots is proceeding. Drought has limited the results from the first year. The trials have again been soil-sampled, prior to the 1966 spring when further fertilizer will be applied.

Potash and Grazing Trials, Glen Innes.—Soil samples were taken at the Shannon Vale Nutrition Station from the grazing trials designed to show the changes in potassium status with different management practices.

Manganese Toxicity.—Results of analyses of soil and leaf samples for the second year of the Terranora Vegetable Station manganese-toxicity trial showed a similar trend to that in the first year. Lime-application still had the same corrective effect on toxicity. There has not been any further significant change in the soil acidity.

Soil-manganese levels, both water-soluble and exchangeable, were much lower at the time of sowing of the first crop in 1965 than at the time of the last harvest in 1964. But these levels gradually increased again towards the end of the 1965 growing season. Manganese-uptake by plants did not follow a similar trend.

There was a definite rise in soil manganese following continuous applications of the higher rates of sulphate of ammonia. Plant-manganese did not follow this trend, except in the nil-lime plots, where the effect of the high sulphate of ammonia treatments was evident.

In the first crop this year, *Sclerotinia* incidence seriously reduced the yield. The disease was fully controlled by spray in the second crop. Yield results from the first crop cannot be used for comparison purposes.

Manganese-toxicity symptoms were pronounced and widespread in the winter crop in June and July, probably an effect of the unusually low temperatures experienced. After statistical evaluation the findings were published in the *Agricultural Gazette of N.S.W.*

The trial will run for another year at the Terranora Station. More information is expected on the residual effects of applications of lime and sulphate of ammonia.

Citrus Nutrition Experiment.—Analytical results of soil samples from the first citrus nutrition pot-experiment at Narara were submitted to the Biometrician.

It has been decided that soil analyses in this experiment will be confined to the initial soil samples and samples taken at the end of the experiment.

Analyses for major nutrient-elements in the initial soil samples collected in 1964 are proceeding.

In co-operation with the Plant Nutrition Section, about 350 soil samples have been analysed for magnesium and calcium to relate soil-magnesium to the leaf-magnesium content in the magnesium-deficiency experiment. These samples were collected in January, 1963, from orchards around Sydney, before magnesium was applied to the test trees as a spray or by soil application.

Magnesium levels in soil samples were found to be closely related to magnesium levels in the leaves and the incidence of magnesium deficiency in the trees. Soil tests for magnesium are showing promise for prediction of soil deficiency.

The work is to be continued in more detail in trials where soil—and spray—dressings have been used.

Investigation of General Fertility Problems.—The number of samples analysed continued to increase. About 2,200 samples were analysed this year, as against some 1,400 last year and 800 the year before. The samples were mainly from District agronomists and fruit officers.

The analyses were for pH, on all of the samples; for available phosphate on 80 per cent of them; for total nitrogen on 10 per cent, for salt content on 60 per cent and for exchangeable bases on 20 per cent.

Many samples from the northwestern cotton areas were analysed for salt content.

Nitrogen Research; Central Western Wheat Soils.—Twenty-nine trials were sown in June-July, 1965. The samples were transported in drums with dry ice for refrigeration and analyses were made for nitrogen as ammonium and nitrate ions. This enabled the values to be used as "at sowing" values. The vegetative response to the applied rates of nitrogen seen up to October tallied closely with the ratings given to the soil from the analyses.

Because of the drought, most of the trials were not harvested. So the soils were used to set up experiments with two other methods—aerobic and anaerobic incubations. Total-nitrogen determinations were also done.

Forty-one trials were sown in May-June, 1966. These included 12 from the higher rainfall area of Cowra district. These have been sub-sampled and most of the analyses for ammonium and nitrate-nitrogen were completed.

Wilting-Point Determinations.—Since N uptake is affected by moisture, a method has been devised to determine the wilting-point percentage. Wheat plants were used in order to duplicate field-conditions as much as possible.

Proposed Rates of N, Trial on Cotton.—Some preliminary work was done in co-operation with Narrabri Agricultural Research Station to examine the distribution of nitrogen (as ammonia or nitrate) around the injection points in an anhydrous ammonia trial. Very little nitrogen was found. Further investigation is needed, to establish when and where losses take place.

SOIL SURVEYING

Mid Clarence Valley.—Following the drafting of the soil-survey report of the Mid-Clarence Valley it was decided to continue the survey in greater detail in some areas. This would meet more closely the needs of pasture research-workers in the area. In particular, studies this year have concentrated on delineating the soil pattern in more detail. The financial assistance of the Australian Meat Research Committee is gratefully acknowledged.

Orange Agricultural Research Station.—The field work of the detailed survey over this Station has been completed. A map and a report have been drawn up. Laboratory analyses of a series of soil samples are proceeding.

Macquarie Region.—Soils along the Macquarie River, downstream from Narromine and within some miles of the river, were inspected to assist local extension staff with the interpretation of soil-survey reports. Subsequently the soils staff at University of Sydney were asked to assist in finding simple measurements to determine the behaviour of the soils under irrigation. This work is in progress.

YANCO RESEARCH LABORATORY

Rice-Soil Testing.—Several hundred soil samples from rice paddocks were obtained from the M.I.A., Coleambally, and Murray Valley areas with the co-operation of field officers. The samples were analysed for nitrogen potential, by incubation under waterlogged conditions. Fertilizer treatment was then recommended for the rice crop. Average district grain-yields rose this year from 2.78 to nearly 3 tons per acre.

Fertilizer trials were also run with the co-operation of the rice research agronomist and a further series of trial soil-samples was analysed. Results showed grain yields were directly related to nitrogen potential, as shown in several previous years, and that response to fertilizer decreased as nitrogen potential increased.

A correlation of 0.95 was obtained between available nitrogen (soil and fertilizer nitrogen) and grain yield.

The group of soils with nitrogen-potential greater than 62 parts per million of nitrogen gave less than 5 per cent increase in grain yield for any fertilizer treatment.

Australian Fertilizers Ltd analysed soil samples by a method adapted to automation, and in general achieved good agreement with Departmental results. However sufficient divergences occurred to require closer study of the methods.

Rice Plant-Density Trials.—Trial plots were laid out with plant spacings of 1, 2, 4, and 8 inches between plants. Design was in 4 x 4 Latin squares with plots 6 ft by 6 ft. Parallel plots were run with extra gaps of 1 ft in each row, and also for soil- and plant-sampling during the growing season.

Results of soil- and plant-analysis showed that closer spaced plants produced more dry matter and absorbed slightly more nitrogen from the soil than did wider spaced plants. However, wide spaced plants maintained higher nutrient levels and gave a higher grain to straw ratio at harvest.

Grain yields average 4 tons per acre and there was no significant difference between the spacings.

"Uptake of nitrogen" studies showed that half the plant uptake occurred after the end of December and most of this in January. This is in agreement with previous results, showing large increases of yield from nitrogen application in early January—except in the most fertile soils.

Plant-counts at the beginning of March showed plants had a potential yield of about 10 tons per acre of grain. Actual topdressing experiments gave yield-increase of about 20 per cent in spite of rapid flow-rate of irrigation water.

Cotton Plant-Analyses.—Analyses of cotton plants from poor and high yielding crops showed that the level of nutrients was somewhat higher in the poor crop than in the other. But amounts of nutrients taken up by the high-yielding crop were several times greater than by the poor-crop plants. This suggests that movement of water is largely responsible for restriction in growth of poor crops.

Fruit Chemistry.—In the "nutrition and quality-studies of peach trees in the M.I.A." it has seemed that little knowledge of the nutritional status of the peach tree could be gained from soil analysis or fruit-quality assessments, but that leaf analysis shows some promise.

A study of the variation of nutrients in leaves from month to month has now been continued over some 27 orchards, selected as above-average orchards by the cannery, to establish some estimate of desirable nutrient levels in the leaves of peach trees. Useful standards are expectd to be established when results over the last three or four years are combined.

Botany Branch

NATIONAL HERBARIUM, ROYAL BOTANIC GARDENS AND ALLIED ACTIVITIES

NATIONAL HERBARIUM

General.—National Herbarium services were maintained at a high level. Botanical staff has been at full strength.

Considerable thought was given by senior and other officers to matter relevant to the preparation of plans for a new Herbarium building, due regard being given to the sizes and efficient placement of rooms in relation to work processes, furnishings, and equipment. Sketch plans and general layout of a new Herbarium building—herbaria, officers' rooms, library, laboratory, and other working space—have been completed. An estimate of cost for construction and installation of fittings has been made, with a tentative three years' building schedule. Funds have yet to be provided.

Botanical Research.—Contributions from the New South Wales National Herbarium, Vol. 3, No. 6, containing two papers on Algae by Valerie May, was published. An index to Vol. 3 was prepared and is in press. Vol. 4, No. 1, containing nine research papers, is still in press. Eight of the nine papers are as detailed in the last annual report. The ninth comprises "Notes on *Acacia deanei*", by Mary D. Tindale.

Four sections of the Flora Series, as detailed in the last Report, are still in press.

Joint research was continued by Dr D. G. Roux, Leather Industries Research Institute, Grahamstown, South Africa, and Dr M. Tindale on the chemotaxonomy of certain Australian species of *Acacia*. Dr Roux visited for progress discussions with Dr Tindale.

The monograph being prepared by Dr Tindale on the *Acacia decurrens* group of wattles, important to the tanning industry, progressed considerably.

A paper, "New Taxa from Eastern Australia No. 2", by Dr Tindale, will be published by the Linnean Society of New South Wales. Four new taxa are described. All are in the *Acacia decurrens* group of tanning bark wattles.

Flowering times in Australia of sixty native species of *Acacia* have been listed, needed for comparison with their flowering periods at the Royal Botanic Gardens, Kew, England.

Preparation of data on some of the fern families for the *Flora of New South Wales,* especially on the Blechnaceae, has progressed; also a monograph on the genus *Cheilanthes* ("Rock Fern").

Dr Tindale examined at the National Herbarium, Melbourne, and the University of Melbourne the specimens relevant to her research on *Acacia, Pultenaea,* and *Pteridophyta.* The bipinnate *Acacia* collection in the Melbourne Herbarium was re-sorted and re-labelled in accordance with her proposed monograph.

The genera *Eucalyptus* and *Juncus* were further studied by Mr L. A. S. Johnson.

Mr Johnson and Dr B. G. Briggs are studying two Australian species of *Typha,* involving taxonomy, cytology, comparison with extra-Australian species, and morphological interpretation; the study is near to completion.

They have also extended a comprehensive study of the taxonomy, cytology, and anatomy of the family Restionaceae, relative to groupings within the family. Three New Zealand species of the family were collected, *Sporodanthus traversii, Leptocarpus simplex,* and *Calorophus minor,* and their chromosome numbers determined. A chromosome count was also made on a Tasmanian species, *Colorophus elongatus,* and the count differed from that found in the New South Wales species which had been included in *Calorophus.* This supports anatomical and morphological indications that division of this genus is necessary.

Chromosome counts were made on several Western Australian species of the family Restionaceae collected by the Director and Chief Botanist. For one of these, *Meeboldiana,* no previous chromosome studies had been made.

The family Proteaceae, for preparation of data for the *Flora of New South Wales,* is now being studied by Messrs McGillivray and Johnson. In connection with this, specimens of *Grevillea* received on loan from the British Museum, Natural History, that were seen by Robert Brown prior to publication of his "Prodromus" have been studied. The comparative study has shown that material known in this Herbarium as *Grevillea aspleniifolia* Knight is actually *G. longifolia* R.Br., and that what has been known as *G. asplenii-folia* var. *sheperdii* F, Muell. is the true *G. aspleniifolia.*

The family Cyperaceae is now being studied by Messrs Evans and Johnson, for preparation of material for the *Flora of New South Wales*. Collection of species not well represented in the Herbarium is progressing.

The family Lemnaceae ("Duckweeds") is being studied by Mr Evans for the *Flora of New South Wales*. This family contains the smallest flowering plants (Wolffia). Some members of its genera *Lemna* and *Spirodela* are also very small. Recent collections have shown more species in New South Wales than previously suspected. Efforts are being made either to collect the flowers and fruit of each species, or to culture them for these minute parts. They are aquatic floating plants and grow readily in culture.

Preparation of material on the family Papilionaceae for the *Flora of New South Wales* has been commenced by Mrs Lee. One section of this family has been dealt with by a previous author. The remaining section contains many of the species of economic importance.

Studies on the seaweeds of the Australian coastline were continued by Mrs Valerie Jones. The Type Specimens of 150 Australian species described by M. Gandoger, recently received on loan from Lyons, France, are under investigation. Gandoger's descriptions were based on duplicate specimens from collectors and botanic institutions (including this Herbarium) in Australia. Many of his "species" are synonyms of names established prior to his publications. His classification of the specimens will be revised here in accordance with current nomenclature, and prepared for publication. Results of this study will be of substantial interest, also, to other Australian Herbaria.

Field Investigations.—Some of the botanists visited the Mt Wareng, Putty and Mt Kindarun districts, and the Mt Keira, Douglas Park, Picton Lakes and Nattai Valley districts; for general field observations and collecting, for special observations on *Acacia fulva,* and to obtain uncommon aquatic plants, sedges, eucalypts and legumes.

Another field trip was to the Yengo and Boree Creek districts between Howes Valley and Wollombi areas. These have been rather inaccessible in the past. Useful material was collected, and observations were made on distribution and variation of species under study. An undescribed *Acacia* species was also found.

A field trip into the mountainous country between Putty and Rylstone provided further important data on the New South Wales flora. Populations of *Xanthorrhoea* yielded some information critical to a revision of the genus soon to be published. Useful observations were made on some Proteaceae.

Dr Syo Kurokawa, of Ueno Park, Tokyo, and Mr R. Filson of the National Herbarium, Melbourne, were accompanied to Mt Wilson to collect lichens. A large number of specimens of *Parmelia* were obtained for this Herbarium.

Dr M. Tindale undertook three field trips in Victoria, in the Mt St Leonard, Apollo Bay and Ewart Park districts. Some rare bipinnate wattles, some ferns, and other specimens were collected.

Dr I. Stone of Melbourne University was accompanied to the Blue Mountains to collect living material of a number of species of ferns.

Dr G. Brownlie of the University of Canterbury, New Zealand, was accompanied on a field trip to Ku-ring-gai Chase to examine some of the Australian species of Pteridophytes which occur also in New Caledonia.

While on leave in New Zealand, Dr B. G. Briggs visited herbaria and laboratories at the Botany Division, D.S.I.R., Christchurch, and the Botany Department, Auckland University. Over 200 specimens were collected, in the field, of groups relevant to current studies on the Australian flora. She also obtained material suitable for current studies on the three New Zealand species of Restionaceae.

The family Proteaceae, especially the genus *Conospermum,* was field studied by Mr McGillivray as part of a current examination of the group.

The Director and Chief Botanist accompanied Western Australian and other visiting botanists on a study tour of the jarrah forests of south-western districts of Western Australia. Living material of members of the family Restionaceae was collected for cytological investigation by Dr Briggs.

Plants New to New South Wales or Now Accepted Formally as Naturalized.—*Hedychium gardnerianum,* an Asiatic member of the ginger family (Zingiberaceae) widely cultivated in gardens but not hitherto recorded as naturalized, was found established and fruiting freely amongst native vegetation in a Naremburn gully; *Pyracantha angustifolia* (Rosaceae), an Asiatic shrub cultivated in gardens, same area and at Northbridge; *Aster novi-belgii* (Compositae), a commonly cultivated perennial Aster, was recorded as naturalized at Northbridge; *Morus alba* (Moraceae), "White Mulberry", a native of Asia, was found amongst native vegetation at Northbridge and is the first species of the genus recorded as naturalized here; *Ochna serrulata,* an African shrub commonly cultivated in gardens, was found to be commonly naturalized in native plant communities at Northbridge and Willoughby, and is the first member of the family Ochnaceae naturalized here; *Citrullus colocynthis* (Cucurbitaceae), "Colocynth", was found in the Bourke and Wanaaring districts and though known to be in other States this was the first definite recording in New South Wales; *Helianthus tuberosus* (Compositae), "Jerusalem Artichoke", was recorded as naturalized at Northbridge; *Spergularia levis* (Caryophyllaceae), a native of South America, was found naturalized at Ingleburn; *Cyperus distachyos* (Cyperaceae), collected some sixteen miles northwest of Bourke is a Mediterranean species known to occur in South Australia but not previously recorded naturalized in New South Wales; *Swainsona plagiotropis* (Papilionaceae), hitherto known only near the Murray River in Victoria, was twice collected near Jerilderie, and the specimens were of special interest because their distinguishing feature helped to justify recognition of *S. plagiotropis* as a distinct species; *Toechima texax* (Melastomataceae) was collected from the Toonumbar State Forest; *Parsonsia tenuis* (Apocynaceae), a small montane rainforest liana not previously collected south of the Queensland border, was obtained from the McPherson Range in New South Wales; *Juncus canadesis* (Juncaceae), a North American "rush", was found naturalized at Wentworth Falls and could become a minor pest of moist places in cool districts; *Froelichia gravillis* (Amaranthaceae), a native of central-southern U.S.A., now found naturalized on river sandbanks near Richmond, was cultivated in the Botanic Gardens, Sydney, early this century; *Scutellaria racemosa* (Labiatae), a native of southern America, reported naturalized in shaded river-bank situations at Liverpool, and found as a garden weed in the Sydney district a few years earlier though not then identified, has a well-developed perennating root system and might potentially be troublesome.

Identity of a weed first collected in 1964 and later in 1966 as *Heterotheca grandiflora* ("Telegraph Weed") was confirmed. It is an annual or biennial member of the family Compositae, native to California where it is common in disturbed ground. It now seems naturalized at Lee Wharf, Newcastle, and at Carrington. In 1932 it was reported to be a noxious weed of pineapple fields in Hawaii but has not received much subsequent notice.

The first specimen of *Dinebra retroflexa* (Gramineae) received at this Herbarium from an Australian locality was obtained from the Darling Downs in Queensland. This is an annual grass, native to Tropical and South Africa, India and, more rarely, southern Europe, in moist sites in dry regions and probably salt-tolerant. In India it is reported to be eaten by stock with other herbage.

Rare Species and Extensions of Range.—

Allania endlicheri, previously only from the Blue Mountains, was collected near Mt Coricudgy.

Styphelia laeta var. *latifolia,* previously recorded only from the Gosford-Hawkesbury River district, was collected at Warialda. Also, the var. *angustifolia,* normally found on the central coast and lower Blue Mountains, was recorded from Warialda.

Aegiceras corniculatum, "Black Mangrove" or "River Mangrove", hitherto not known south of Port Hacking, was found at the Minnamurra River, near Kiama.

Opercularia varia was collected at Hilltop, whereas the the nearest previous collections were on the south coast and the Blue Mountains.

Phyllanthus microcladus was found in the Wiangaree State Forest, Richmond River, and this may be the first finding in New South Wales since Beckler collected the Type Specimen in the latter half of the last century.

Juncus caespiticus was collected at Kurnell; a small native rush only twice previously obtained in New South Wales although fairly common in the southern States.

Epacris coriacea was obtained from near Mt Coricudgy; literature records the distribution as "Coast district and dividing range from Hunter River to Illawarra district" but the only previous specimen in the Herbarium were from the Helensburgh-Bulli Pass-Macquarie Pass area.

Cordyline stricta, previously known only from the Wyong district northwards, was collected from Mountain Lagoon, north of Kurrajong Heights.

Isopogon fletcheri, a rare member of the Proteaceae, rediscovered on cliffs below Govett's Leap, Blackheath, was last collected about 50 years ago despite more recent searches.

Eucalyptus spp.—Material received from the Nadgee River in the extreme southeast of New South Wales was of a previously unknown species of *Eucalyptus,* of mallee habit, related to *E. maidenii* but quite distinct. Flowering material of another new species was also received, a tall tree of the "Ash" group of *Eucalyptus* only recently discovered in the Big Badja Mountain district near the head of the Shoalhaven River.

Pilularia novae-hollandiae, a member of the Marsileaceae, was collected at Doonside. It occurs chiefly on the southwest slopes, where its fruiting bodies are often an impurity of sub clover seed.

Phyllanthus filicaulis was obtained from Regentville, near Penrith; the last record on the central coast was in 1905.

Swainsona monticola, known chiefly from the tablelands of New South Wales, was re-discovered persisting in the Campbelltown area where, prior to 1910, it was more common.

Nassella trichotoma, "Serrated Tussock", was received from the Bega River on the south coast. Most infestations of it have been reported from the tablelands.

Pyrrhosia confluens, an epiphytic fern, was collected at Peat's Ridge, a southwards extension.

Papillaria flexicaulis, a moss, was found on trees in the Toonumbar State Forest. The last previous New South Wales specimen in the Herbarium was collected in 1898.

Symphionema montanum (Proteaceae), previously not known to be north of Mt Wilson, was found NNW of Putty.

Rutidosus heterogama (Compositae), hitherto only known from the Newcastle district, was collected on the Brooms Head road south of Maclean on the north coast.

Diplotaxis tenuifolia, "Sand Rocket", a cruciferous weed which occurs in Victoria and South Australia, and in New South Wales previously recorded only from Deniliquin, was found on roadsides near Bunyan, north of Cooma. It is not a serious weed.

Plants Poisonous to Humans.—A list of plants in this State considered likely causes of human poisoning, with notes on their toxic constituents, and symptoms, was compiled for the Toxicology Branch, Commonwealth Department of Health.

"Drought-hardy", Special Identifications. — Thirty-one voucher-specimens (of 19 species) from samples taken for Chemistry Branch analysis of protein content were identified at the Herbarium. The specimens were from the Moree district where drought was accentuating the need to find suitable feed among hardy species.

"Marihuana", Special Identifications.—Plant materials confiscated by Customs from an overseas ship were identified as dried leaves, stems, and seeds of *Cannabis sativa,* "Marihuana" or "Indian Hemp".

A large quantity of freshly collected "Marihuana" plants, from the Hunter River district, together with packeted dried leaves and stems, were identified for the Police Vice Squad.

Other, Special Identifications.—Because of a recent inquiry the scientific names applied by J. Banks and D. Solander in *Illustrations of the Botany of Captain Cook's Voyage Round the Word,* Parts I (1900), II (1901), and III (1905) were studied. Changes in several of the names applied are needed, some for nomenclatural reasons and some because of misdeterminations.

For the Police Department fragments of plants were examined and reported upon in connection with a case of "attempted murder" at Warriewood, and a case of "break, enter, and steal" at Beresfield.

The Girrakool Nature Trials area of the Brisbane Water National Park was visited at the invitation of the Trust, to identify and label living specimens of shrubs and trees.

The School of Biological Sciences, University of Sydney, was helped to identify seeds found in peat beds from the north coast.

At Megalong, Blackheath, native trees, shrubs, climbers, and herbs along a "Nature Trail" sponsored by the Blackheath Rotary Club were identified.

An organism contaminating a ground tank and apparently causing death of sheep was identified as *Anacystis* sp., a microscopic alga.

Herbarium Exchanges.—Botanical exchanges with other institutions continued, though outward flow was slowed by other work; 2,241 specimens were received fom overseas institutions and 1,924 from Australian institutions; 443 specimens were sent to 10 overseas and 2 Australian institutions.

Fifty Pteridophyte specimens from New Guinea were donated to the Herbarium by Mrs P. Messmer. Duplicate specimens of ferns and lichens from Lord Howe Island were received from Mr J. Game. Mr G. V. Schammel donated the remainder of his herbarium of native orchids and a number of drawings of orchids, lantern slides, and reprints.

Field Collections and Seed Exchanges.—Twenty-four packets of seed were dispatched to Ecuador; 117 samples of seed were received from overseas institutions, 10 from interstate institutions, 18 from New South Wales sources and 9 from members of the staff.

Considerable living plant material was received from various parts of Australia for growing in the Royal Botanic Gardens.

Loans.—Plant specimens were loaned for botanical studies at the University of Sydney, University of Western Australia, Queensland University, University of Adelaide, and University of Tasmania; Singapore Botanic Gardens; Royal Botanic Gardens, Kew, England; Westfalischen Wilhelms-Universitat, Munster, Germany; Waite Institute, Adelaide; University of Otago, New Zealand; CSIRO, Canberra; National Science Museum, Tokyo, Japan; State Herbarium of South Australia; Rijksherbarium, Leiden, Netherlands; D.S.I.R., Christchurch, New Zealand; National Herbarium, Melbourne; Smithsonian Institution, Washington, D.C., U.S.A.; and Botanischer Garten und Museum, Berlin-Dahlem.

The Botanical Collector.—The Botanical Collector spent 55 days in the field collecting seed, herbarium specimens for record and exchange, and other plant materials for specific botanical research. Extended trips were made to the north coast, northern tablelands, south coast, and Mangarlowe areas, the Douglas Park (Nepean River), Bargo, Fitzroy Falls, Belmore Falls, and Carrington Falls districts, and the Nepean Dam, Berrima, Upper Burragorang, Hilltop, and Camden areas. Brief collecting trips were made to various sites on the Blue Mountains and central coast.

Study Visitors Accommodated.—Notable visitors granted facilities for study at the National Herbarium and with whom discussions and consultations occurred in relation to their particular studies, were variously from the Botanic Gardens, Canberra; CSIRO, Canberra; Australian National University, Canberra; Darwin; Botanic Museum and Herbarium, Brisbane; University of New England, Armidale; University of Sydney; University of Melbourne; University of Tasmania; Waite Institute, Adelaide; Flinders University, Adelaide; Kings Park and Botanic Garden, Perth; New Guinea; Victoria University, New Zealand; University of Canterbury, New Zealand; Great Britain; University of Cologne, Germany; Rhodes University, South Africa; Brooklyn Botanic Gardens, N.Y., U.S.A.; University of Delhi, India; National Science Museum, Tokyo, Japan; West Pakistan, and Bechuanaland.

Lectures.—The District and Chief Botanist lectured to the South-west Regional and Northern Regional Conferences of Department of Agriculture officers, on "The History of the Royal Botanic Gardens in Relation to Agriculture", and to the Bathurst Naturalists' Society on "The Royal Botanic Gardens in Relation to Horticulture".

Dr M. Tindale addressed the Weed Society of New South Wales, at the National Herbarium, on identification of weeds and on collecting plant specimens for identification.

The Botanical Collector also lectured on "The History and Functions of the Royal Botanic Gardens" to the V.I.E.W. Clubs of Belmore, Bexley, Blacktown, Dee Why, Penshurst, and Strathfield, and the Australian Institute of Horticulturists; on "Gardening" to a Girl Guides' Association, on "Botanical Collecting" to the Katoomba and District Wildlife Conservation Society, and on "Seed Dispersal" to the Leura Garden Club. He also recorded three radio talks at Tamworth for rural sessions.

Conducted Tours of the Herbarium and/or Royal Botanic Gardens.—These were arranged for the V.I.E.W. Clubs of Beverly Hills and Oatley, the Ladies Auxiliary of Sydney High School, Teacher College Trainees, Western Suburbs C.W.A., Oatley Flora and Fauna Preservation Society, and the Ikebana International Conference.

Miss N. Ford conducted Asquith Girls' High School pupils on a tour of the Herbarium, explaining its contents and functions.

Miscellaneous Services.—At Werris Creek Court evidence was given on identification of plant material in a case of alleged theft of bales of fodder. Expert evidence was given for Hornsby Shire Council in an appeal before the Land and Valuation Court regarding siting of a proposed industry.

The Herbarium was represented at the Opening of the new Botanic Garden in Kings Park, Perth, W.A.; at a meeting of the Systematic Botany Committee of Section M of ANZAAS in Tasmania; at the Inaugural Meeting of Council of the Australian Conservation Foundation at Canberra.

Dr Barbara Briggs has been elected to the Board of Associated Editors of the journal *Evolution*. This journal published in the U.S.A. has a wide international circulation and is an important medium for publication of research and theoretical papers.

Mr L. A. S. Johnson has been appointed as a scientific representative on the "Sim Committee" set up to advise the Minister for Lands and Mines on north coast areas for which there are conflicting conservation and sand-mining demands.

ROYAL BOTANIC GARDENS

Superintendent's Retirement.—Mr C. R. G. Grant retired, after 15 years as Superintendent of the Royal Botanic Gardens and Allied Areas and 41 years in the service of the Department. Mr W. R. Watson was promoted to the Superintendent position on 13th June, 1966.

Drought and Water Restrictions.—Although drought conditions prevailed the grounds were maintained at a satisfactorily high level. But, because water restrictions were inevitable, many plants suffered severely, a few have been lost, and the final effects may not yet be evident in others. The heavy autumn rains have restored most of the Gardens collection to normal growth.

Constructional and Restorative Improvements.—General improvements included construction of walls and cut-stone edging of reflection pools in the entrance-forecourt, near Art Gallery Bridge; reformation of pathways and kerbings; a new diversion pathway behind Government House; reconstructions in the glasshouse-area and commencement of a new large aluminium glasshouse; harder sandstone-replacement of two flights of stone steps at approaches to the Pioneer Women's Memorial Garden; removal of a decayed wooden pergola adjacent to the succulents garden; excavations below the Phillip Fountain (Garden Palace grounds) for installation of a water re-circulation pump; commencement of the Sir Leslie Morshead Memorial Fountain at Shakespeare Place entrance; and restoration and silicone painting of the Lower Garden Lysicrates monument.

Plantings and Allied Improvements.—Cultivated areas heavily infested with nut-grass were fumigated before planting to shrubberies; gardening and landscaping improvements included regrading and returfing large areas of irregularly shaped lawn, planting of additional species to the Native Border, and complete planting-up of new beds at Art Gallery Bridge entrance and the three large new beds extending from Shakespeare Place entrance along Macquarie Street where native species have been the particular feature.

The Macquarie Street plantings are compensatory for shrubberies lost when the Expressway was constructed through the Garden Palace grounds in 1960.

Nursery and Glasshouses.—Nursery stock was cared for adequately in spite of watering limitations. Ample advanced plants were provided for the large-scale plantings undertaken. The introduction section was expanded with exchange material from Departmental nurseries in this and other States, and from commercial nurseries.

In the glasshouses, arranged public displays of selected species included *Calceolaria, Cymbidium, Anthurium* and a wide range of showy-foliage plants. Additional indoor species were obtained from various sources. These included newly introduced orchids and carnivorous plants—*Pinguicula* ("Butterwort"), *Dionaea* ("Venus' Fly Trap"), *Sarracenia* ("American Pitcher-Plant"), *Drosera* ("Sundew"), and *Utricularia* ("Bladderwort").

Glasshouse staff again set up and maintained plant and floral decorations for official rooms and government stands at the Royal Easter Show, and at Parliament House and some Government offices.

Landscape Designing.—The previous years' backlog of work for other governmental and semi-governmental institutions was greatly reduced following appointment of a Landscape Designer to assist the Senior Landscape Designer.

The Senior Landscape Designer made inspections and prepared plans and/or reports of landscaping schemes for the following: Abbotsford Quarantine Station; Albury Council (proposed Cemetery Area); Bonnyrigg High School; Brush Farm Child Welfare Establishment; Canley Vale High School; Corrimal High School; Cowra Offices of the Soil Conservation Service and Department of Agriculture; Cundletown Pool Committee; Lady Carrington Centenary Memorial Hospital (Camden); Lidcombe Remand Home (Department of Child Welfare); Miller High School; Newington College; Prince Henry Hospital; N.S.W. Public Library (main entrance at Shakespeare Place); Quirindi Council (traffic channelization); Registrar-General's Department (forecourt at Queen's Square); Scone High School; Sydney County Council (Redfern Depot); Vaucluse House Trust; Wagga Teachers' College; Wollongong Teachers' College; Water Board (Chatswood Depot); and Yanco Agricultural College.

Landscaping plans were prepared and shrubbery plantings were supervised for Art Gallery Bridge entrance and Shakespeare Place entrance to the Royal Botanic Gardens, and for the large beds along Macquarie Street.

The Senior Landscape Designer delivered a second series of lectures to post-graduate students in the Town Planning Course at the University of Sydney.

Queen's Square Area.—Arrangements were completed with the Registrar-General's Department for maintenance of the forecourt area fronting the offices at Queen's Square. The Senior Landscape Designer prepared a plan, and construction in the area will be supervised by the Department of Public Works. This section of land was previously maintained by the City Council. But it has been agreed that this area shall come under Royal Botanic Gardens control for development and maintenance.

Garden Study Tours.—The Royal Botanic Gardens was again visited by an ever-increasing number of groups of schoolchildren and students undertaking botany study tours. Some 500 in groups came from University of New South Wales and a similar number from Sydney University Botany School.

Vandalism.—This continued to be a problem in the Gardens. Labels and garden seats were removed and damaged. Statues were disfigured or broken. A shocking case this year was the wrenching-away of parts of the figure of the foal from the bronze statue "The Mare and Foal" in the Lower Garden near the pond and sea-wall. The figure of the foal was recovered but is so badly damaged that the two front feet require complete remodelling. Arrangements are in hand for a well-known sculptor to restore the group.

CENTENNIAL PARK; INCLUDING QUEEN'S PARK

Additional Funds.—For the second consecutive year the Government provided, additional to normal maintenance costs, a special vote of $60,000 for restorative and developmental work in Centennial and Queen's Park. Restorative and developmental expenditures of this fund were the responsibility of the inter-departmental Centennial Park Supervisory Committee.

Maintenance.—General maintenance of the two Parks is the responsibility of the Royal Botanic Gardens administration. The section of staff located at Centennial Park did the routine maintenance as well as any of the developmental work that could be done with the normally available equipment. The remainder of the restorative and developmental work was/is done by Public Works Department and/or outside contractors.

Following the intensive "cleaning-up" activities of the previous year the improved condition of the areas has been adequately maintained, in spite of drought conditions and water restrictions. The floral areas and the shrubberies were favourably commented on in the press and on television.

Plantings.—Many trees and shrubs were planted in selected areas and have become established. The species include—*Eucalyptus andreana, E. bicostata, E. grandis, Acacia elata, A. decurrens, A. murrayana, A. riceana, A. vestita, A. gillii, A. kempeana, A. podalyriifolia, A. brachystachya, A. penninervis, A. juncifolia, A. botrycephala,* and *A. microbotrya.*

Plantings on such a scale had not been undertaken for a great many years, and are needed at this time to replace older shrubs and trees, just as development of a broad landscaping scheme is needed. Concurrently the nursery area has been expanded. Also, the potting-shed has been rebuilt and bottom heat has been installed in the glasshouse.

Buildings.—To advance its programme of replacement of obsolete and dilapitated buildings the Supervisory Committee allocated funds to construct the southern wing of the depot block, and new stables for the Rangers' four horses. All structures were built of brick with concrete floors, by contract work. Insufficient funds were available this year to replace the old wooden buildings of the western block. This construction should be undertaken in the coming financial year. There would then be a completely up-to-date depot set-up, worthy of the Park and its place in the community's life.

A number of other buildings in disrepair (shelters, dressing-sheds and toilets) were renovated in Centennial and Queen's Parks by Public Works Department, with an allocation from the special fund.

Equipment.—A further $3,000 worth of equipment was obtained, using the special fund. This followed some $10,000 worth in the previous year. The items included irrigation piping, a spray unit, concrete mixer, fertilizer spreader, saw bench, power drill, power back-saw, chain saw, steam cleaner, ripper, and a heating unit for metal fence repairs. Also a 5-ton truck was secured on transfer. This is to transport another new item, an elevator platform for use in tree-lopping. The latter has yet to be delivered.

The Ponds.—There are twelve pond areas in Centennial Park. The whole system, of sixty acres, forms a storage for rain-water drainage from the heights of Woollahra, Waverley and Randwick and opens to a run-off system through Kensington and other southern suburbs, finally entering Botany Bay. The individual ponds are separated by a series of embankments. The most northerly (Pond No. 6, adjacent to the Eastern Suburbs Hospital) is some fifty feet higher than the most southerly (No. 9, adjacent to old tram track from Anzac Parade to the eastern suburbs).

Over the years these ponds have developed weed-growth and/or become heavily silted. In its first year (1964–65) the Supervisory Committee arranged for weed-clearance and de-silting of the eastern portion of Pond No. 12. This year (1965–66) the western portion of Pond No. 12, and also Ponds Nos. 1 and 2 bordering Musgrave Drive, have been dealt with. Reeds (*Eleocharis sphacelata*) and silt were removed to give a greater free-water surface, but enough reeds were left to give protection to waterfowl.

Borders of the treated ponds were grassed with Kikuyu grass runners (*Pennisetum clandestinum*).

Pond clearance was done by contract, with heavy earth-moving equipment. The spoil was used to build up low-lying patches in the landscaping area in the southwest section.

Landscaping.—Besides the general plantings undertaken as part of overall landscaping (see "Plantings" paragraph, earlier) the particular southwestern section to be developed by landscaping, commenced last year, was this year taken a step forward. This was by adding and grading the spoil taken from the desilting of Ponds Nos. 12, 1 and 2.

Further grading and more soil are needed but grassing and some planting will proceed in the spring of 1966. Part of the area was affected by heavy flooding in April, 1966. Levels need to be raised to prepare the area for effective development.

Fencing.—Progress has been made by renewing the park-rail fence along the eastern and southeastern sides of Queen's Park, and by painting the iron spike fence of Centennial Park along Lang Road from Oxford Street to Jervois Avenue. The Supervisory Committee made funds available for this work. The iron spikes were cleaned down and painted steel-grey. Damaged coping was renewed in cement, and coloured to resemble the sandstone of the remaining coping. Sections of the fence damaged in collisions by vehicles were restored along Lang Road. For this the ironwork was refashioned by the Transport Department's Randwick workshops.

The Supervisory Committee also authorized complete placement of the old unserviceable iron spike fence surrounding the Bird Sanctuary near the Depot. A new cyclone-type fence was erected.

Parking Control.—There was continued contravention of the regulation which prohibits parking of vehicles on any lawn, grass plot, garden or footpath in the Centennial Park. More assistance than in the past was provided by the Police Department in providing greater quantities of barriers at the time of the Royal Easter Show. But more permanent physical barriers would be needed to prevent vehicles from being driven off the roadways.

This year the Supervisory Committee allocated certain funds for initiation of such work. A row of 2-in galvanised pipes is being erected vertically along the border of the Grand Drive footwalk. This will allow cars to park between the trees but not extend over the pathway. Also, kerbing and guttering of the western section of Dickens Drive has been completed. This is to prevent the driving of vehicles on to the well-kept lawn areas around the flower-beds. The levels of this road varied so much that the whole section had to be remade and unfortunately absorbed much of the available funds.

Drought and Underground Water Supply.—Drought and water restrictions were a serious threat to the scheme of plantings. A decision was made by the Supervisory Committee to investigate the possible tapping of underground water. Department of Agriculture and Water Conservation and Irrigation Commission officers inspected the area and, as a result, a number of test spear-points were put down. A good supply of underground water was obtained. The drought had broken when this water was tapped but plans are now being developed to install a pumping unit and a large-scale irrigation system from this supply to water the sand riding-track and playing fields.

Flooding, and Water Outflow Restrictions.—With a local breaking of the drought in February, 1966, rains recorded in February and March were well above average and, again, torrential rains late in April yielded over 10 inches in two days. Extensive flooding occurred throughout the Park. Ponds Nos. 2, 6, 4, 5 and 12 flooded over their embankments. Water covered the roadways, playing fields and garden beds. Part of the sand riding-track facing Pond No. 2 was washed away and required considerable restorative fiilling.

At the same time, Pond No. 9 on the southern boundary of the Park, the pond where all overflow from other ponds collects, extended its water over the greater part of the low-lying area in this section of the Park. The water spread almost as far as the Grand Drive in one part, and over part of the southwestern area which is being built up for landscaping.

The outlet pipe and the spillway through the Transport Department's property outside the southern fence of the Park are not capable of carrying sufficient outflow to maintain Pond No. 9 about constant level at times of torrential rain. But the situation was aggravated on this occasion by the presence of a concrete wall constructed to a height of three or more feet above the spillway level. This wall had been erected at short notice by Randwick Municipal Council just before flooding. The Council claimed that the wall would retard the rush of excess waters from natural drainage channels through the Park, and so prevent the type of flooding alleged to have occurred on earlier occasions to residences in Kensington.

On this occasion, in April, 1966, the flooding around Pond No. 9 was extensive and lasted some 36 hours. Prolonged floodings of this type would lead to the loss of woody plant species in the area, and noticeably affect the growth of plants in the area being developed by landscaping.

After Departmental discussions the Transport Department requested Randwick Council to remove the wall, but the Council obtained a judicial injunction. At 30th June, 1966, no judgment has been delivered, following the subsequent court hearing.

Installation of a controllable floodgate in place of the solid wall would be acceptable. It would prevent excessive and prolonged flooding in the Park, without flooding premises downstream.

Water Board Installations and Contribution.—The Metropolitan Water and Sewerage Board completed the erection and fencing off of a new pumping station adjacent to Centennial No. 1 Reservoir, and later undertook restoration of surrounding parkland disturbed during the construction.

The Board's second annual contribution for maintenance and development of the reservoir embankments comprised $1,000, for the period up to September, 1966. Some of this has been used to provide labour for general maintenance of established embankments and to hire earthmoving equipment to restore the embankment along the Oxford Street border of Centennial No. 2 Reservoir. Extensive regrading has been undertaken there to improve the final appearance of this section when it is grassed and replanted with shrubs.

Model Aeroplane Clubs.—Two model aeroplane flying clubs have for many years been licensed to operate on Sundays in Centennial Park. With renewed public appreciation and attendance in the Park the noise from the model-flying was a subject of some concern or irritation. Therefore, the sites of operation were moved from much-used to less-frequented and more secluded places below the southern embankment of Pond No. 12.

These fields are situated between the Gymkhana area and the No. 4 playing field of the Sydney Boys' High School. Negotiations to permit the use of the latter field, maintained by the High School authorities (including voluntary workers of the

Parents' and Citizens' Association), met with strong opposition from the school although the agreement of occupany precludes exclusive use by the High School students. It has been decided that, at the present time, use of this area for extra-school sporting activities will not be pressed.

Roadways Signposted.—All of the designated roadways (see last year's annual report) have now been properly signposted, facilitating the marking of exact locations throughout Centennial Park.

General.—Mrs R. Moore, of Killara, presented a 5-year-old mare, "Glissade", for the exclusive use of the Centennial Park rangers. This is the third hack donated for the purpose by Mrs Moore over the last eight years. Her generosity is greatly appreciated.

Waverley Municipal Council has constructed a stormwater pipe to carry surface drainage from Carrington Road into the drainage system which passes below the surface of Queen's Park to empty into Pond No. 1 in Centennial Park. Previously an open drain from Carrington Road had damaged Queen's Park by gullying and the deposition of rubbish from the Council's roads.

A drinking trough, and a bubbler, were installed in the area adjacent to Centennial Park Pond No. 1, used each Sunday morning by the Eastern Suburbs Dog Training Club.

The Domains

All areas in the Outer and Inner Domains were satisfactorily maintained. The shrubberies suffered only a little due to water restrictions. Sufficient grass growth on the playing fields was sustained for activities through the dry period.

Improvements and Restorations.—Several dead and old, decaying Moreton Bay and Port Jackson fig trees were removed from the Outer Domain in preparation for further tree plantings in the coming year. The Sydney City Council finalized all work needed following construction of the underground parking station in the southeast corner of the Outer Domain. This included formation of new pathways, restoration of disturbed pathways and steps to the entrance portico, re-surfacing of the asphalt border to playing fields constructed above the parking station, and restoration of a disturbed area to the north of the station, adjacent to the Eastern Suburbs Railway enclosure.

Parking and Traffic Channelization.—The contracted period following reconstruction of Mrs Macquarie's Road East beside the County Council's Electricity Substation having ended, the roadway was once again opened to traffic in a one-way direction from north to south.

On recommendations from the Department of Agriculture the Parking Advisory Committee undertook re-arrangement of parking for the whole of Mrs Macquarie's Road from Art Gallery Bridge (spanning the Eastern Expressway) to Mrs Macquarie's Point and return. This resulted in restricted parking (1 hour, 2 hours, and 4 hours) for visitors to the Royal Botanic Gardens and the Point; also a length without restriction, on Mrs Macquarie's Road East, closer to the City than the previous unrestricted section, enabling City employees to park all day. The new parking regulations and the one-way traffic throughout has facilitated traffic movement, particularly on the northern half of the roadway. Parking there is completely prohibited on one side of the narrow roadway.

Domain Baths.—The Trustees of the Royal Botanic Gardens and Government Domain have approved of the design of the new swimming baths the City Council intends to build, to replace the existing outmoded and deteriorating structure. Re-arrangement of roadways near the baths will be required to permit buses to turn and park, and landscaping will be undertaken on the embankment between the building and the roadway.

Eastern Suburbs Railway.—An area surrounding two-tunnel entrances facing Sir John Young Crescent, separated by a paling fence from the rest of the Domain and enclosing a number of out-of-use buildings, received Railways Department attention. This followed complaints from the Trustees.

The old buildings were demolished and excess weed-growth together with accumulated rubbish was removed. But, as work on construction of the railway may be resumed, a more restricted enclosure—to surround only the tunnel mouths—was not agreed to by the Railways Department. The affected area is adjacent to the National Art Gallery. This most unattractive paling fence should be removed.

Art Gallery Extensions.—The Trustees have approved alienation of a section of land to the east of the present National Art Gallery where building extensions will be undertaken. In exchange, a portion of land now controlled by the Art Gallery Authorities will be returned to the Outer Domain.

General.—Parking of cars on a limited area of grassed surface was permitted in the Outer Domain during the transport strikes on 5th July and 30th August, 1965, and for a week near Christmas to help shoppers visiting the City.

The Domain playing fields were used regularly for sporting activities; also for assemblies such as the Anzac Day Celebration, the Apprenticeship March, and others.

The County Council continued the laying of the underground cable across the Outer Domain to the Law Courts.

Government House

Inner Domain gardening staff maintained Government House Grounds, and provided floral decorations within the building.

A particularly fine floral garden display was at its best when His Excellency the Governor, Sir Roden Cutler took up residence in February, 1966.

An area adjacent to the rockery at the southeast corner of Government House has been completely replanted, and native species have been set out along the northeastern fence.

Admiralty House

Royal Botanic Gardens gardening staff maintained the grounds of Admiralty House, the Governor-General's Sydney residence and provided floral decorations within the building. The Commonwealth Government recompenses the State.

The grounds were very satisfactorily maintained. Supplementary watering was available from an underground tank.

This year it was agreed with the Comptroller of the Household that the hothouse should be converted into an unheated propagating glasshouse.

At the time of the Queen Mother's visit to Australia in April, 1966, the then foreman Mr N. Silk and Mr N. Morrisson were transported to Canberra to assist in the decoration of Federal Government House at Yarralumla for the Royal visit.

Mr G. W. Gillham, who was in charge of Admiralty House ground for 18 years, retired in September, 1965, after 40 years' service in the Department. Mr N. Silk was then promoted to the position of foreman. Regrettably, he died, in June, 1966.

DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

Agricultural Research Institute, Wagga Wagga

SOME STAFF HIGHLIGHTS

Director's Research Fellowship in New Zealand.—Dr A. T. Pugsley, Director of the Agricultural Research Institute, Wagga Wagga, was awarded a Senior Research Fellowship with the Department of Scientific and Industrial Research, New Zealand. He spent six months with the Crop Research Division, Lincoln and was engaged in comparative studies of Australian and New Zealand wheats with respect to their disease resistance and phasic developmental patterns.

Research Officer's Afghanistan Project.—Under a grant from the Wheat Industry Research Council Mr G. M. Halloran accompanied a British expedition from the University of Reading to Afghanistan to collect primitive forms of bread wheat and related species. Some 1,800 specimens were collected. These were predominantly wheats but barleys, oats, grasses and legume species were also obtained. The wheat material will be grown under quarantine at the Institute, then made available to wheat breeders in Australia and overseas.

Research Officer's Science Review Award.—The Australian Institute of Agricultural Science Review Prize for 1965 was awarded to Mr A. N. Smith, Senior Research Officer of the Institute. The subject of Mr Smith's review was "Aluminium and Iron Phosphates in Soils."

WHEAT IMPROVEMENT

Achievements of Institute Varieties.—Heron continued to be the most popular variety in New South Wales. It was sown over 1,176,773 acres in 1964–65 and comprised 19.8 per cent of the total acreage for the State. Extensive trials in Victoria have shown it to be generally superior to Insignia, the leading variety of that State.

Falcon, released in 1960, was the second most popular variety. It occupied 11.2 per cent of the sown acreage. Premium purchases of this variety for 1965–66 were about treble those of the previous year and more Falcon than any other variety was purchased at a premium.

Raven, noted for its multiple disease resistance, is currently recommended by the South Australian Department of Agriculture and rapidly gaining in popularity in that State.

Comparative Trials and New Lines.—Drought led to abandonment of trials at Condobolin, but valuable results were secured at other centres.

The recommended varieties performed relatively well under the dry conditions; Heron and its close derivatives showed remarkable tolerance to drought.

Twenty-six new lines were included in larger plot trials in 1965. Six of these were promoted to wider testing in 1966, ten were continued in the same trials, and ten were rejected.

KF Heron, carrying the Sr_9 gene for stem rust resistance, is slightly earlier than and over the past five years has usually outyielded Heron. Nucleus seed has been distributed to Registered Seed Growers in anticipation of its release at the conclusion of the 1966–67 crop year.

S Heron, which more closely resembled Heron, carries the Sr_6 gene for stem rust resistance, the Ml gene for leaf rust and mildew resistance, and a single dominant gene for resistance to loose smut. However, the reported presence of loose smut in this line last season has necessitated further examination of the nature of its resistance, particularly in regard to possible new races of *Ustilago tritici.*

Additional stem rust resistances originating from *Triticum timopheevi* and *Agropyron elongatum* have each been incorported in a Heron background and in both cases certain morphological characteristics seem to be associated with each type of resistance. It is of interest to report that mature-plant resistance to powdery mildew is very closely linked with the stem rust resistance of the *T. timopheevi* strain.

The project aimed at improving Falcon, the present hard-wheat standard for yield and quality, has been carried forward. Derivatives with stem rust resistance, winterness and short straw are now being selected and yield-tested—some in larger plot trials at several centres.

Semi-dwarf Wheats.—The first semi-dwarf introductions into Australia were made in 1956. Since then they have attracted widespread interest. They promise means of adding significant yield increments to Australian wheats.

Mexico 120 again returned very high yields; 92.6 bushels per acre under irrigation at Leeton. This introduction and another, Chile 1B, possess undesirable quality characteristics. So in future they will be restricted in use as parental material only.

Other locally produced crossbreds of acceptable quality have been carried on to advanced trials.

Basic Studies of Phasic Development.—The wide range of variation in developmental patterns in the bread wheats, coupled with new knowledge of the genetics and physiology of the underlying processes, has prompted further work in this field. External conditions of day-length and temperature not only influence the time of ear emergence and maturity but also may influence other growth processes such as tillering, height and ear size. Furthermore, interactions of these external factors with developmental patterns may greatly influence the plant's response to potentially damaging freezing temperatures in the field.

Recognition of several component processes is of great significance because they have been shown to be conditioned by a limited number of major genes. From this it follows that near-isogenic lines can be produced. These may then be used in further experiments, in the field and in controlled growth chambers. Considerable progress in this direction has been made.

Cytogenetics.—Production of monosomics in the two varieties Heron and Falcon from the Chinese Spring set has continued, with a further backcross of each of the 21 monosomic lines with respective recurrent parents—Heron and Falcon. Production of monosomic lines in each of these varieties is expected to be completed early in 1967.

Addition of rye (*Secale cereale*) chromosomes individually to the wheat complement has continued. This year the seven monosomic and some of the disomic rye additions to the variety Heron should be available.

Concurrent with the above activities the rye chromosomes are being substituted for those chromosomes of the B genome of the variety Heron. This is to produce wheats which, besides being commercially suitable, possess desirable characteristics borne by the rye chromosomes. Of particular interest, and a problem of great significance to wheat growing in the southern region of New South Wales, is the incorporation of *Ophiobolus graminis* (take-all) resistance of rye in wheat by this means.

Resistance to *Ophiobolus graminis* (take-all) has been located in the genus *Agropyron, Agr. domianum.* This species has been crossed with the local wheats KF Heron and Falcon in a programme for incorporation of this resistance in wheat, as with rye.

Recent work in the cytogenetics programme has demonstrated firstly that *Haynaldia villosa* can be crossed to hexaploid wheat and, secondly, that in the absence of chromosome 5B of wheat its chromosomes pair with those of wheat. The significance of these findings is that genetic variation in the genus *Haynaldia* can now be added to the potential range available for wheat improvement. Such findings will also enable more detailed evolutionary studies to be carried out between the genus *Haynaldia* and the genus *Triticum.* The wheat-*Haynaldia* crosses are to be further grown, and evalulated for *Haynaldia* characters likely to be useful for wheat improvement.

Inter-varietal chromosome substitution lines and aneuploid lines in the variety Chinese Spring have been used to study the genetic basis of phasic development in bread wheat. These studies have provided new evidence upon the genetic basis of vernalization and photoperiodic response in wheat. This could be of a definite relevance to the task of breeding for yield improvement in wheat. These findings also have evolutionary implications which may help to explain the successful spread and cultivation of tetraploid and hexaploid wheats in such a diverse range of environments throughout the world.

Irrigated Wheat.—Experiments in the Coleambally Irrigation Area brought out several points of interest. The locally bred semi-dwarf wheat NBJ 115 gave the highest grain yield in each trial, and was less subject to lodging and shattering deficiencies than other varieties.

Nitrogen fertilizer application resulted in large yield increases and also reduced damage caused by a severe infection of the "take-all" disease. Application of 40 lb N an acre more than halved the estimated yield loss due to this disease.

Development of wheats of the Pinnacle type, with improved agronomic features and stem rust resistance, is receiving attention, for their possible value in irrigated wheat production.

WHEAT QUALITY INVESTIGATIONS

The Test-baking Unit.—The Institute's test-baking unit has been reorganized for installation of equipment for micro test-baking of early generation material, and installation of another experimental dough moulder. The new moulder will provide greater flexibility in assessing dough behaviour. Preliminary trials with it have already confirmed views held about varietal differences in the behaviour of doughs subject to different moulding treatments.

Flour Sedimentation Studies.—These are being applied to all samples from the past harvest. As with other quality tests, however, interpretation is complicated by the abnormally high protein content of most lines from the 1965 harvest.

Starch and Gluten Variables.—The study of the part played by these in determining some major physical dough-quality characteristics reported last year has been in abeyance. This was until additional dough-testing equipment was delivered in mid-June. Extension of findings reported last year to the new testing techniques has now commenced. This will proceed uninterrupted for the rest of the year.

Genetics of Grain Hardness.—Further work on this and significance in baking quality awaits appointment of a research officer to the vacant position.

OAT IMPROVEMENT

Cooba's Wide Acceptance.—From the time of its release in 1961 the grazing variety Cooba has become widely accepted. Now it is the second from most popular variety throughout the State. It is the only variety currently recommended for all agricultural regions.

F.B.D.F. Crossbred.—The promising crossbred (Fulmark x Ballidu) x (Dale x Fulghum) again performed well at the testing centres Wagga, Henty, and Temora. Over the past five years F.B.D.F. has outyielded all other varieties under light grazing with subsequent grain recovery. Its outstanding feature is fast early growth. It is only slightly inferior to Cooba when sown early (end of February to mid-March) and grazed heavily. In grain yields, when not grazed, F.B.D.F. is only inferior to Avon and Bundy.

In view of this excellent yield performance for all purposes the naming of F.B.D.F. is proposed for this season. This crosbred is likely to become a useful and popular variety for the southern and central districts, and could replace Fulghum and/or Fulmark.

F.B.D.F. is early in maturity, has a short and strong straw, but the grain is not suitable for milling purposes. Foundation seed has been distributed to registered seed growers in the southern and central districts.

Avon x Osage Crossbred.—The promising Avon x Osage has been equal to Avon in grain yield over the past three years, and appears slightly superior to Avon in green fodder production and grain quality. Further tests are needed to assess beyond doubt that this crossbred can replace the now leading variety Avon.

Root-comparative Study.—In root-observation boxes a comparative study is being made of two grazing varieties—Cooba and Klein, and two grain varieties—Ballidu and Avon. Only small differences were evident at the first grazing stage. But subsequently there was a greatly superior root development of the two grazing varieties.

Seeding and Fertilizer Rates.—The economics of increased seeding rates and nitrogen fertilization are being assessed in relation to winter feed production.

WEED INVESTIGATIONS

Effect of Herbicides on Skeleton Weed.—In post-emergence application to wheat and oats at the 5-leaf stage, MCPB sodium salts (particularly an emulsifiable concentrate, at ½ to 4 lb a.e. per ac.), picloram at 0.4, 0.8 and 1.0 oz a.e./ac., and picloram + 2,4-D mixtures in varying proportions at 4 and 8 oz total active ingredient, gave good control of skeleton weed. Ioxynil at ¼ to 2 lb a.i./acre and the triazines GS 14254 and GS 14260 were relatively ineffective. MCPB, ioxynil and the triazines had no effect on crop yields but picloram at 0.8 and 1.0 oz a.e. and the higher concentrations of the 2,4-D + picloram mixtures reduced wheat yield slightly. Application of picloram (0.5 oz and 1.0 oz a.e./ac.) at the 2 and 4 leaf stages also reduced grain yields slightly.

In glasshouse experiments soils were screened from contact with picloram. These suggested that the main response in wheat may be due to uptake via the root.

In pre-sowing and pre-emergence applications to skeleton weed, picloram at 0.2, 0.4 and 0.8 oz a.e./ac. gave satisfactory weed control but did not give consistent increases in grain yield. Picloram + dicamba + 2,4-D mixtures (2,4-D at 4 and 8 oz a.e./ac. + picloram: dicamba in various ratios at ½, 1 and 2 oz total active ingredient) suppressed weed growth for varying periods. Increasing the 2,4-D or picloram + dicamba content of the spray lengthened the period of suppression. The response of oats and wheat to these sprays was somewhat variable. Increasing the 2,4-D content tended to decrease yields, whereas increasing the picloram + dicamba content tended to increase yield. Maximum yield was obtained when the ratio of picloram to 2,4-D + dicamba was greatest.

Weed Control in Wheat.—In post-emergence trials for control of *Amsinckia hispida, Polygonum aviculare, Papaver* spp., *Avena fatua, Lolium rigidum* and *Vulpia bromoides* in wheat, a 2,4-D + picloram mixture (12:1) at 4 oz a.e./ac. and above gave good control of dicots. MCPB sodium salt at 1 lb and above controlled poppies but was only moderately successful against dicots. The emulsifiable concentrate of MCPB was slightly more effective than the water soluble form. Ioxynil at 1 lb a.i. gave satisfactory control of *A. hispida* and *Papaver* sp. GS 14254 triazine at ½ lb controlled the dicots and was also successful against *A. fatua* and *V. bromoides.*

In pre-emergence trials, trichloracetonitrite at 10 oz a.e. and picloram at 0.4 oz a.e. per acre controlled dicotyledonous weeds but tended to reduce grain yield. Both dichlobenil and the triazine GS 14260 at 1 lb gave good control of *Lolium rigidum* and *A. fatua* and retarded dicots present. Both materials increased grain yield significantly.

PASTURE HUSBANDRY

Stocking Rates/Superphosphate Rates Trial.—The stocking rates (2, 4, and 6 dry sheep)/superphosphates rates (0, 1, 2, 3 cwt per acre per year) trial which was started in 1962 will finish at the end of 1966. A cropping phase will then follow for three years, and in this period the soil fertility levels of the various grazing treatments will be evaluated.

This trial is located on land of moderate to low fertility and responses to superphosphate were expected to be high.

The residual effect of 600 lb superphosphate, applied during a 15 years rotation of fallow-crop prior to this trial, was notable. Not until spring, 1965, did pastures on the nil-super plots produce significantly less than those on supered plots.

For the whole period, to date, sheep livewights on nil-super plots have not been bettered by those on super-fertilized plots. During the autumn of 1966, sheep liveweights have actually been maintained at a higher level on non-supered plots in spite of the fact that there is less available feed on these plots. It is assumed that this is related to pasture composition.

On super-fertilized plots the change to grass dominance has occurred more rapidly and barley grass is now a major pasture component. On non-supered plots the clover component is still righ enough to maintain sheep in better condition than on barley-grass dominant plots.

In two of the four autumns it was necessary to feed the 6 sheep per acre treatments a maintenance ration of oats for a few weeks. However an economic analysis of results to date suggests that 6 sheep on nil-super plots have produced the highest net return per acre.

The next step is to examine the situation where a breeding flock is maintained under similar conditions. Reactions are unlikely to be the same, since the feed requirements of the breeding flock fluctuate widely. Therefore the effects of some special types of management, including use of supplementary pastures, are to be examined. This is to determine whether or not they can aid production from sub clover and ryegrass, to better meet feed requirements and more efficiently utilize available feed.

Lucerne is expected to help supplement the dry annuals in the summertime and oats is expected to fill the gap in midwinter when the annual pasture is practically dormant. The supplements are intended primarily to assist in turning off lambs.

Lamb Production Factors.—The district practice of mating in the spring, to avoid the grass seed problem and to catch the early market, needs scrutiny.

Ewe fertility is known to be much higher in the autumn than the spring and the grass seed problem might be overcome by management practices. Also, lambs dropped in spring usually exhibit greater vigour as temperatures are rising.

Use of green fodder crop supplementation after lambing could increase growth rates and enable spring lambs to be sold before the end of December.

A trial comprising two stocking rates, spring and autumn lambing, and four systems of management including use of special-purpose supplementary pastures has been designed. Border Leicester x Merino ewes are to be mated to Dorset Horn Rams as is normal and recommended district practice. Grazing is expected to commence in the spring of 1966. Dry conditions in 1965 prevented clover establishment good enough for earlier commencement.

Effects of the various treatments are to be measured in terms of prime lamb production and wool production over at least three years.

Results will be examined in economic as well as physical terms, bearing in mind the difference in the general level of prices at different times of the year.

Carrying Capacity of Dry-land Lucerne.—A closer look at the potential carrying-capacity of dry-land lucerne under intensive management has been planned as a separate trial. Using breeding ewes under two stocking rates, and two levels of subdivision for rotational grazing, the trial has been designed to determine in this district the carrying capacity of lucerne over the period when the basic sub clover and wimmera ryegrass pasture is not producing sufficient green feed. A higher stocking rate at times of low sub clover/ryegrass production should permit more efficient use of the pasture at times of surplus.

PLANT PHYSIOLOGY

Drought Resistance and Water-use Efficiency Investigations.—The buildings being planned for this purpose at the time of the last Report have now been completed. The experimental work has begun.

The programme is directed at raising yield in the wheat crop. To assist in clarifying the role of various factors in determining the level of yield achieved, in the region served by the Wagga Agricultural Research Institute, a study has been made of the long-term variations of yield that have been experienced in the past.

This study has suggested that the economic condition of the wheat industry has been a powerful stimulus to changes in land use; changes which have in turn determined to a large extent the average level of wheat yield.

It is predicted that, if the same set of factors continue in the near future to operate as they have done in the past, the general yield level is likely to decline in the next few years.

The detailed results of this study are now in preparation for publication.

PLANT PATHOLOGY

A Wheat-Bunt Fungicide-resistance Problem.—This season's main work was concerned with investigations on a wheat-bunt (a *Tilletia foetida* race) which has proved resistant to hexachlorobenzene (HCB). An extensive field trial demonstrated the race to be completely resistant to the chemical, even at the maximum rate of 2,000 p.p.m. Almost complete control was affected by HCB at 300 p.p.m. on ordinary *T. foetida* and *T. caries.*

The trial also showed that the race is resistant to the other chlorobenzenes, tetrachloronitroanisole and pentachloronitrobenzene. It does not lose its resistance several generations away from BCH.

In a varietal response trial there were clear indications from a number of wheat varieties that the race also differs physiologically from ordinary *T. foetida.*

An *in vitro* screening test was devised. This was used to compare the activity, on bunt, of various fungicides. Some of these are extensively used for bunt control overseas. The most promising will be evaluated in the field.

Bunt collections were received from bunted crops in Western Australia (1), New South Wales (4), and Victoria (17). All the Victorian collections were resistant to HCB but the others were not.

AGRONOMIC SURVEY UNIT

Factors in Nitrogen Uptake.—The relationship evident in 1964–65, between crop nitrogen uptake at flowering and total mineral nitrogen in the soil profile (0 to 3 feet) at sowing time, was not reproduced in 1965–66. No meaningful relation between soil and crop factors could be found in 1965–66. This possibly reflected the wide range of seasonal conditions occurring at the observation sites.

It is of interest that in 90 per cent of the situations so far studied, over two seasons, crop nitrogen-uptake to flowering was less than the total mineral-nitrogen available in the top two feet of soil at sowing. In the other situations, crop nitrogen-uptake at flowering was more than matched by the total mineral-nitrogen in the whole soil profile (0 to 3 feet).

Despite the seeming adequacy of total mineral-nitrogen levels in the soil, significant positive responses to nitrogen fertilizer were obtained in nine out of 43 situations. The conditions which determine this response to nitrogen fertilizer are still not clearly understood.

SOIL-TESTING PILOT SCHEME

Fertilizer-predictive Soil-testing.—The investigation of soil testing as a means of predicting fertilizer requirements of wheat was commenced in 1964. It is in its final year.

Evaluation of the 1964 series of trials has been completed. *Preliminary* results of the 1965 series are available. Sowing of the 1966 series of 32 trials was completed early in June.

From the 1964 trials, very encouraging correlations between soil analysis and yield increase were established. The degree of correlation was greater for the "with nitrogen" than for the "no nitrogen" treatments.

Climatically, the 1965 season was unfavourable. Sowing was delayed by the late break in the season. Yields from the trials varied greatly. Preliminary correlations between yield and soil phosphate analysis were markedly inferior to the 1964 series. Contrary to earlier observations the degree of correlation was lower in the presence of nitrogen applications than in their absence. This is attributed to the season's adverse climatic conditions.

The mobile field unit has continued to operate satisfactorily although the need for a more efficient method of harvesting was apparent.

Soil-sampling Problems Studied.—Two problems in soil sampling—the number of samples needed to obtain a sufficiently accurate representation of the soil status in a paddock, and the variation in results from samples taken monthly throughout the year—are under continued study.

It has been found that from 27 to 60 samples are necessary, depending on the analysis to be performed.

Values obtained on the monthly samples fluctuated inconsistently. Some part of these differences may be due to the moisture status of the soil. But it is clear that whatever the contribution of seasonal effects may be, the variations between monthly samplings will influence the accuracy of the advice based on soil tests.

SOIL CHEMISTRY

Superphosphate Time and Method Trials.—Two experiments inquiring into the advantages of different times and methods of applying superphosphate to wheat were carried out this year.

Superphosphate was applied at rates of 0, 50, or 200 lb per acre, either by drilling at sowing *or* by broadcasting at sowing *or* at 10, 20, or 30 days after seedling emergence.

Application by drilling at sowing gave the greatest increase in yield per lb of superphosphate applied, but broadcasting 200 lb at 10 days after emergence also gave significant yield increases.

Growth-stage Effect on Fertilizer-response.—Differences in stages of growth may result in differences in the pattern of a crop's response to fertilizers. The subject was studied using three wheat varieties—Thatcher, Falcon, and Sunset; grown in pots under three daylengths—8, 12, and 20 hours. Monocalcium phosphate was applied at various times before and after floral initiation.

The growth of the plants, the weight of plant parts, the uptake of phosphorus, and the grain yield, were all affected by the treatments. It appeared that the shorter the interval between sowing and floral initiation, the more the yield increase due to phosphate application was reduced as the application time became later.

This effect is probably due not merely to phase of development. Other factors such as temperature, length of growing period, and supply of nutrients, would also play a part.

Superphosphate Residual Values Studied.—The continued application of superphosphate to soils has led to an interest in residual values, and the hope that on soils where application rates have been high the fixation mechanisms in the soil may be approaching saturation.

Twelve pairs of soils were obtained from widely distributed locations in New South Wales. One of each pair had a known superphosphate history, and the other was from an adjacent site known to have had no superphosphate.

Superphosphate was mixed with all of the soils, in the laboratory. The amounts of phosphate in four different inorganic fractions were determined.

It was found that in some cases the more superphosphate that had been applied to the soil the less was the amount of added superphosphate which went into the iron phosphates fraction. Further pairs of soils are being studied to see if the same relationship holds.

The correlation between the ratio of aluminium phosphates to iron phosphates and water soluble phosphates was found to be very highly significant. The implications of this are being studied.

Soil Nitrogen and Wheat Yield.—Evaluation of the relationship between wheat yield and "available nitrogen" indices, determined by a number of chemical and biological methods, was commenced in 1965. This was continued on a further 31 sites in the region during 1966.

Statistical analysis of this data, using appropriate mathematical models, will indicate the applicability of a nitrogen soil-test for wheat in southern New South Wales. These nitrogen soil-tests are also being evaluated under glasshouse conditions with perennial ryegrass as the test crop.

Fallowing and Wheat Production.—The influence of the length and method of fallow preparation on available nitrogen concentration, moisture conservation and weed control, relative to wheat production on subterranean clover improved soils at Wagga Wagga, was reported in the 1964–65 Annual Report (p. 103).

The general applicability of a short fallow preparation and the possible use of herbicides are being investigated at four sites in the southern New South Wales wheat belt. The sites have been selected to give a range of rainfall and fertility status as determined by previous land use.

Nitrogen Fertilizer Types and Wheat.—The suitability of nitrogen fertilizers—sulphate of ammonia, urea, sodium nitrate, ammonium nitrate, and anhydrous ammonia—for wheat, were studied during 1965 at Wagga Wagga. The fertilizers were applied at 40 lb nitrogen per acre, at sowing or in the early spring.

Average grain yield was increased from 34.0 to 38.6 bushels per acre by the application of nitrogen. But there were no differences due either to the form of nitrogen or the time of application.

Grain protein was increased from 11.6 per cent to 13.6 per cent–14.6 per cent, by applications of anhydrous ammonia and urea applications at sowing and by ammonium nitrate and sodium nitrate applications early in spring. The investigations are being continued.

Nitrogen Fixation Study.—The possibility that the free-living nitrogen-fixing organisms, *Azotobacter* spp. and *Clostridium* spp. may contribute to nitrogen nutrition of the wheat plant was studied under field conditions during 1965. The trial was carried out in co-operation with Dr A. D. Rovira, CSIRO Division of Soils. He has reported some evidence of yield increases due to seed inoculation with these organisms under South Australian conditions.

Under local conditions in 1965 there was no response by wheat inoculated with either of these organisms. The experiment is being repeated during 1966 under high and low fertility conditions.

Nitrogen Accumulation under Subterranean Clover.—The accumulation of soil nitrogen and organic matter was measured under a subterranean clover-ryegrass pasture established in 1962. This was on an arable soil which had received 636 lb superphosphate under a 15-year fallow-wheat rotation.

Analysis of the surface 4 inches showed no significant treatment effect on total carbon or soil nitrogen. However, significant increases in mean organic carbon and soil nitrogen (0.087 per cent to 0.101 per cent) occurred between 1962 and 1965. This increase was equivalent to 60 lb N/acre 4 in/annum.

The apparent lack of a relationship between nitrogen accretion and annual superphosphate applications (0, 1, 2, and 3 cwt/acre) may be associated with the residual inorganic phosphorus level in the soil (50.9 p.p.m.) being adequate for clover nitrogen fixation.

A trend (non-significant) in soil nitrogen accretion of 216, 186, and 146 lb N/acre 4 inches also occurred under stocking rates of 2, 4, and 6 sheep per acre respectively. This was over a period of three years.

The results of the trial so far suggest that: (i) in a rotation with a relatively short period of clover ley before returning to a cropping sequence, stocking rate may not significantly influence soil nitrogen accretion; (ii) residual phosphorus from the superphosphate applied during the cropping phase of the rotation may be adequate under local conditions to promote clover growth and nitrogen fixation.

Agricultural Research Station, Tamworth

Rainfall throughout the year was the lowest ever recorded in the Tamworth district and this was so also for the northwest in general. Field research was so affected that many results were of doubtful value.

WHEAT BREEDING

The wheat-breeding programme was sustained under limited irrigation, using Station facilities and others generously made available by co-operating northwesterners.

Seed-increase of a number of semi-dwarf Dural type durum wheats from the breeding programme was initiated. Grain will shortly be available from this material for intensive yield and quality determinations.

In the hybrid-wheat breeding programme the research included studies of "seed-set" on male sterile wheats, anther cytology of male-sterile plants, and inheritance of fertility-restoration. Back-crossings to transfer male-sterility and fertility-restoration to local material, and produce hybrids for a study of heterosis, were carried out.

WHEAT NUTRITION

In the Wheat Nutrition section the fieldwork was limited by the drought. Only two of the original thirty trials planned produced results. The opportunity was taken to analyse in detail and prepare for publication the results from 1962 to 1964.

Also, further major improvements were incorporated into the mobile field plant.

THE CEREAL CHEMISTRY LABORATORY

This was fully equipped and became operative during the 1965–66 season. The work comprised evaluation of material from the wheat-breeding programme, in co-operation with the Bread Research Institute of Australia and the Cereal Chemist, Department of Agriculture, Sydney.

A technique for milling and baking of wheat samples grown in the northwest was developed; also a method of assaying flour samples for Alpha-amylase activity.

Further work was done on development of a micro-baking test using 10g samples of flour. And the Pelshenke Test for evaluation of plant breeders' samples was re-examined.

PLANT PHYSIOLOGY SECTION

The main work continued to be studies on the light and temperature effects on phasic development of wheat.

Modifications in experimental design during 1965–66 included replacement of the variety Cheyenne with the semi-dwarf Mexico 120 in the varietal set, extension of the number of photo-period treatments by supplementary illumination, and comparison of vernalized material with non-vernalized controls under all treatments

Initial treatment of the 1965 data indicates relationships similar to those obtained in 1964 for the effects of vernalization, temperature, photo-period varietal phase and variety. Preparation of all data for computer analysis is proceeding.

FROST PHYSIOLOGY SECTION

The technique for laboratory screening of wheat varieties for resistance to frost damage was further developed. About 300 varieties and lines from a number of sources were examined in detail and subsequently classified.

The Director of Research at this Station, Dr W. V. Single, departed in January 1966 on a study tour of frost-research centres in Japan, U.S.A., Britain and Europe. The study tour, financed by the Australian Research Council, is concurrent with a Rockefeller post-doctorate research fellowship for about six months. For this period Dr Single will work at the University of Michigan.

PLANT NUTRITION SECTION

The 1965–66 work indicated lucerne to be dependent on soil nitrogen during establishment but subsequently independent.

Lucerne gave significant responses to phosphorus on seven of twelve representative wheat-belt soils.

Severe sulphur deficiency was induced in lucerne pot-grown on ten of twelve soils, by repeated removal of tops after harvesting. Where soil sulphur was deficient the nitrogen level of lucerne increased as a result of sulphur application.

Lucerne yield-response to applied phosphorus was found to be similar to that of wheat, qualitatively but not quantitatively. Results suggested that lucerne containing less than 0.19 per cent phosphorus would indicate the soil to be deficient in phosphorus for growth of wheat.

Field experiments were started, to determine the initial and long-term phosphorus and sulphur requirements of white clover, and also the contribution of legumes to wheat-soil productivity.

WEED SECTION

Weed investigations were restricted by the drought. Some useful results were obtained.

A pilot trial indicated a range of susceptibility in varieties of wheat to the weedicide barban, and that Festiguay is more susceptible to it than is Gamenya.

Grain samples of wild oats taken in 1958 and 1963 from wheat silos throughout the State were examined and showed that *Avena fatua* is more widespread in southern areas and *Avena ludoviciana* more common in northern areas of the State.

PASTURE RESEARCH SECTION

The field programme is concerned with granitic soils of the southern parts of the New England tablelands, and the arable sedimentary soils of the wheat belt.

In the granitic soils, the effects of nutrients, cultural practices, strains of root nodule bacteria, and the species and varieties of legumes, on fixation and build-up of nitrogen are being studied.

In the arable wheat soils all phases of plant testing are being carried out: preliminary Phase I (at present only with summer-growing legumes); Phase II (grasses and temperate legumes); and Phase III (grazing evaluation of lucerne).

Laboratory and glasshouse studies are being expanded, from counts of rhizobia and limited tests of strain differences, to a full programme of evaluation of local isolates of root nodule bacteria.

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

Scope

This Division conducts research into economic aspects of rural production and marketing and provides extension services in farm management and farm economics. It is responsible also for administration of the Marketing of Primary Products Act, 1927–1965, and in this connection, a comprehensive market-reporting system, periodic crop-forecasts, and crop and pastural reviews.

Economic Research

COST-BENEFIT ANALYSIS, BORDER RIVER IRRIGATION SCHEME

This was a study requested by the Department of Conservation. A detailed report has been submitted to that Department. There is acute lack of data, and the study was not conclusive. It was impossible to derive an estimate of the likely increase in production as a result of the scheme. Even so, much valuable information was obtained.

For N.S.W. the benefits would be almost exclusively irrigation. Therefore the total public costs of the scheme were compared with quantity of water made available and an average cost per unit of irrigation water was obtained.

Profitability of the use of this water for ten possible irrigation enterprises was then studied. Break-even yields or carrying capacities had to be devised where accurate estimates of these were not available. Of the ten irrigation water-uses studied only two seemed potentially economic. No estimates could be made of total benefits arising from these water-uses because of the many assumptions on which the results had to be based.

Experience from this study indicates that, if there are frequent future demands for benefit/cost studies of proposed public irrigation works, a small specialized-staff will be needed. The work is detailed and time-consuming.

FUTURES-MARKET SURVEY

The theoretical principles behind futures markets were studied and the use of the Sydney Greasy Wool Futures Market by New South Wales woolgrowers was investigated. The results were published in the *Review of Marketing and Agricultural Economics.*

It was shown that futures-markets definitely contribute to the efficiency of the marketing function. They do so by permitting specialization in the functions of price-formation and uncertainty-bearing. Economies are thereby effected in storage and processing and in the allocation of resources over time.

Woolgrowers could use the futures-market to fix the price of their clip in advance and to improve the efficiency of their short-term resource-use. With ability to predict prices they could profitably use the market.

The survey revealed that less than one per cent of New South Wales woolgrowers used the Sydney Wool-Futures Market. The main reason for doing so was to attempt to outguess the market. The attempt in each case was unsuccessful.

COSTS OF HARVESTING IRRIGATION CROPS

This study was completed during the year. It was based on a survey of 30 header-owners in the Murrumbidgee Irrigation Area and was designed to ascertain the cost of owning a header, versus the cost of employing a contractor, to harvest crops grown under irrigation in southwestern N.S.W. The main conclusions reached were—

(i) Economies of scale for ownership of self-propelled headers become exhausted at about 360 acres of *rice* per year. This occurs at around 180 acres for tractor-drawn headers.

(ii) For harvesting *irrigated winter-cereals* with self-propelled headers, scale-economies almost disappear at about 1,500 acres per annum. For the tractor-drawn header this occurs at about 800 acres of crop.

(iii) Header-replacement every ten years is less expensive than replacement every five years, even after taking into account the relative effects of taxation allowances.

(iv) The comparative financial advantage that ten-year ownership has over five-year ownership decreases as the level of taxable income increases, and also as the amount of contract-harvesting performed increases.

(v) In 90 per cent of years there is a surplus of about 66 self-propelled and 47 engine-functioned headers in the Murrumbidgee Irrigation Area. In effect, if header-owners were prepared to operate their machines for the full harvest each season, a theoretical reduction of 45 per cent in the numbers of serviceable self-propelled and engine-functioned headers would be feasible.

(vi) If header-numbers were rationalized along the aforementioned lines, savings to the farming community and the economy in general could be many thousands of dollars. This would be by a reduction in per acre costs of header-operation, due to increased utilization of machines, thus allowing lower contract-rates.

(vii) Present header-numbers in the Murrumbidgee Irrigation Area could safely harvest *more than* the following *additional* areas nine years in ten: (*a*) 29,000 acres of rice; (*b*) 63,000 acres of irrigated wheat; (*c*) 59,000 acres of irrigated oats and barley.

The study will be published in the *Review of Marketing and Agricultural Economics.*

ECONOMIC SURVEY OF BEEF CATTLE PRODUCTION

Considerable progress was made with this project. The main objectives were to provide a guide to the economic structure of the industry in cattle-raising regions of the north coast, to specify management-problems needing investigation in this area, and to assess the potential economic benefits of technical research in progress at Grafton Agricultural Research Station.

Sixty-three farms were included in the field survey done in August and September, 1965. The farms were chosen at random. Each operator was interviewed personally.

A preliminary report of the survey has been drafted. It will be submitted to the Australian Meat Research Committee prior to publication. The report outlines present trends in beef production in the area, lists the investment-alternatives presently available to beef producers, and provides a detailed background of management practices and an assessment of resource-potential.

In a second stage the project will undertake an analysis incorporating financial data from the survey farms. The objectives will be to determine net farm-income from survey-farmers, and attempt isolation of factors affecting net farm income. Much of the analysis has been completed. A report is expected during 1966.

ECONOMICS OF FODDER CONSERVATION USING FORAGE HARVESTERS

This project was referred to in last year's Report. It has been completed. An article on it was published in *Farm Management.*

POULTRY MANAGEMENT IN THE SYDNEY AREA

The main purpose of the study has been to investigate the economic and physical basis of successful poultry farming and to establish comparative standards to aid extension work in poultry farm management.

Data were collected continuously over eight years. Collection of data was discontinued at 30th June, 1965, as further accumulation of data was not considered necessary. The possibility of reorganizing the study was investigated and then abandoned due to practical difficulties.

A preliminary report summarizing the results of the study for 1963–64 and 1964–65 has been completed but has not yet been issued. It indicates that the major causes of low returns to management in egg production are insufficient farm size, inefficient use of labour, and low production.

A final report on the whole study is in course of preparation.

ECONOMICS OF WHEAT STORAGE

The objective is to assess the advantages and disadvantages of different types of wheat storage and to estimate the real cost of such storage facilities in N.S.W. The project has been continued. A draft report has been prepared.

Work is also proceeding on development of a wheat-storage plan for the State with respect to optimum quantity, form, and location of wheat-storage facilities.

Data have been obtained to estimate the real annual total, average and marginal cost-curves of on-farm storage (steel silos, grain sheds and weldmesh bins beneath existing sheds) and Grain Elevators Board storage (concrete multi-bin silos, steel bulkheads and wheat depots). The data were secured by a stratified mail-survey of 1,580 farmers, firms who market farm storage units, the Grain Elevators Board and the New South Wales Department of Railways.

Using the results of the estimated-cost curves and other data collected from the survey, an optimum storage programme will be developed using a transportation model, and a game theory model.

A draft of the study on storage costs should be finished early in the new financial year but work on the optimum storage-model problem will probably extend in 1967.

ECONOMICS OF WHEAT SEGREGATION

Progress has been limited partly by methodological difficulties but mainly because of the need to take to an advanced stage the aforementioned project on wheat storage before proceeding with the work on segregation.

The goal of the study is to analyse and assess the economic benefits and costs, and the effect on structure of the wheat market, of a proposal to segregate wheat in New South Wales into hard and soft classes. More specifically, this project will try to establish whether grading wheat in New South Wales will benefit the State wheat industry financially or not—after this market innovation has had its full economic impact on the domestic and world wheat-market.

The grading-system to be considered is that suggested as technically and administratively feasible by the Department's Chemistry Branch. It comprises segregation of all wheat delivered at country receiving-points, into the following quality classes: (*a*) Hard Wheat; (*b*) "F.a.q."—similar quality to the present f.a.q. sample but exhibiting greater homogeneity; (*c*) Soft Wheat.

This grading-system would apply to the existing f.a.q. sample, but retaining the present system of premium hard and soft wheat.

Unfortunately an objective analysis in terms of dollars and cents is likely to be hampered by lack of sufficient and detailed data. Market structure, conduct and performance are being studied and quantified. The probable direction of costs and benefits from the proposal can be determined from this analysis. These benefits will be compared with estimated costs of implementing a grading-system, using cost-accounting methods to estimate costs.

ECONOMICS OF THE NORTH COAST DAIRY INDUSTRY

This is a major, continuing study. It has been referred to in Reports for several years past. It is investigating the economic aspect of adjustment-alternatives for dairy farmers on the far north coast; aiming to improve farm-management extension service and provide background-information on policy matters affecting the dairy industry.

A report on one section of this study was completed this year and published in the *Review of Marketing and Agricultural Economics*. A linear-programming model was used in considering adjustment-alternatives on a typical problem-farm in the red basaltic soils area. Attention was given to the roles of dairying, beef cattle, pigs, and small crops, on the farm, and to seasonal credit-problems.

The results indicated that farmers on smaller farms should develop small-crop sidelines. However, uncertainty about the influence of income-variability on farm-planning precluded a firm conclusion on this.

In developing background information for the adjustment-situation in the region, an approximate cohort-analysis was applied in a comparative study of the age-structure of the male, dairy-farm work-force in Victoria, New South Wales, and Queensland.

Although the mean-age in each State at the 1961 census was between 40 and 41 years, there were major differences between States in losses from particular cohorts. For example, the percentage losses from the 1947, 15–29 years cohort, by the 1961 census were 1.3 per cent for Victoria, 29.9 per cent for New South Wales, and 25.0 per cent for Queensland. The work demonstrated that cohort-analysis can be applied to Australian census data and so lead to a better understanding of underlying demographic-changes.

A research article describing the study is to be published in the *Australian Journal of Agricultural Economics.*

A third section of the project is nearing completion. It is a study of the adjustment-history of far north coast dairy farmers over the period July, 1960, to 30th June, 1964. (The study excludes the area served by the Casino Co-operative Dairy Factory.)

Of the 3,648 dairy farms included at the start of the period: only 71 per cent were still being farmed by the same owner at the end of the period; 15 per cent were being used for dairying by a new owner; 2.7 per cent had been absorbed by other farms; 9.5 per cent had changed to beef production; and 2.3 per cent had changed to sugar cane production or miscellaneous uses. These figures confirm that north coast farmers are under severe stress due to relatively low incomes.

The remaining sections of the study are expected to be completed by early 1967.

WHOLE-FARM STUDIES: FAR NORTH COAST

This long-term project is continuing to give most encouraging results. The aims are: (i) to ascertain whether research recommendations are satisfactory under practical farming conditions; (ii) to observe estimates of returns on capital invested, and of the time taken for loans to be repaid; and (iii) to study the physical and financial problems faced by farmers in applying recommendations.

The project, which already included seven farms, was this year extended to include another farm. This one is in the Tweed Valley. It is being treated as a special case-study of rapid-development. It will complement the other studies. These have proceeded at a slower rate. The rapid-development study should be especially significant for low-income farmers. They need urgent measures to overcome adverse financial situation.

OPTIMUM FEED-YEAR PROGRAMMES

Preliminary work has been undertaken on a new project to supplement the work already in progress on economic aspects of feed-year programmes on north coast dairy farms. The new project will use linear-programming to determine optimum combinations of different species and pasture-management practices, for farms of various types and sizes, on the major soil types.

The results will be very useful for extension of feed-year systems on the north coast.

ECONOMICS OF LARGE-AREA M.I.A. FARMS

This is a study aiming towards optimum organization of large-area farms in the Murrumbidgee Irrigation Area under various assumptions. The assumptions relate to produce-prices, resource-supplies, input-output coefficients and production-possibilities. Some of the more specific problems are:

(i) Determination of the minimum economic-size of farms, using price and cost-levels likely to face farmers in this area in the future.

(ii) Arrival at optimum farm-programmes using world-parity prices for these farms' main products, such as rice and cotton, and evaluating the income generated; compared with programmes based on ruling prices.

(iii) Testing the profitability of programmes using realistic water-charges, based on inclusion of an amount to write off the capital debt on storage and reticulation structures erected by the Government to establish the area. Water-charges at present do not include any allowance for amortization of the capital debt. They cover only the annual costs of maintaining the structures in working order.

The technique to be used in this study is linear programming, together with some of its many variations such as variable price- and resource-programming.

A survey of a stratified sample of properties in the 400–700-acre size group in the Murrumbidgee Irrigation Area has commenced. So far, 21 of the 39 farmers chosen have been interviewed. The questionnaire seeks details of input-output coefficients for various enterprises, farm-programmes and resource-restrictions.

COLEAMBALLY ECONOMICS

This long-term study has been continued. The aims were set out in detail in last year's Report.

There have been difficulties in getting satisfactory records from farmers. It now appears that useful records will be available from only 18 or 19 farms. Four or five of these will date from early 1960, four from 1961, and ten from mid-1962.

Records kept include details of all farm income and expenditure, and an inventory of all assets and liabilities at 30th June each year—based on a valuation of each property by valuers of the Rural Bank and officers of the Water Conservation and Irrigation Commission.

It has not been possible as yet to produce a progress report. There have been delays in finalizing some farmers' records. Also, through other work, an ancillary study has had to be postponed. This one is aimed at determining optimum development-plans on the farms being studied, using linear programming.

OPTIMUM FARM-PROGRAMMES FOR BERRIQUIN IRRIGATION DISTRICT

The basic objective of this project is to determine optimum programmes for farms in the Berriquin Irrigation District. Subsidiary objectives are: to study the effect of the ratio of irrigated land to dry land on several different types of farms, to investigate the effect of proposed water-restrictions on optimum farm-programmes, and to study the on-farm adjustments needed to maintain reasonable levels of income if the proposed water-restrictions are introduced.

Two separate groups of farmers have been surveyed. The first comprises 38 farmers selected as being particularly "good" or recognized as particularly co-operative in providing information. The purpose with this group is to obtain specific input-output data.

The second group comprises over 20 farmers selected at random. These have also been interviewed for data on resource-restrictions and to provide an assessment of current farm-income levels.

Subsequently linear programming will be used to study farm-programmes. Good progress has been made with this project. It should be completed during 1967.

PRIVATE CO-OPERATIVE IRRIGATION SCHEMES

The study referred to in last year's Report has been continued. The objectives are: to formulate optimum development plans for a group of farmers who have recently commenced irrigating from a private irrigation scheme in the southwest, and to compare optimum-development plans with actual plans.

Subsidiary objectives are: to study the effect of the ratio of irrigated land to dry land on farms, to determine the farmers' aims and attitudes towards irrigation-development in view of the fact that these farms have been viable dry-land units for generations, and to consider the value of this type of private irrigation as an efficient method of utilizing water.

The originally intended approach, viz., that farmers should keep records for five years, has been discarded in favour of a survey-approach by questionnaire. A very detailed questionnaire is being used. Consequently field progress is relatively slow. So far, ten farmers have been interviewed. All remaining farmers who are willing to participate will be interviewed. The project should be completed by the end of 1967.

STOCKING RATES IN SOUTHERN, MARGINAL WHEAT-AREAS

Data from the survey referred to in last year's report were found insufficient for an analysis. A more intensive survey, involving personal interviews, is needed. It will also be necessary to analyse information likely to become available from a trial being conducted at the Agricultural Research Station, Yanco, to evaluate the effect of dry-area pastures and increased stocking rates on lamb and wool production.

Economists have collaborated with technical research staff in formulating the details of that trial, so that input-output data suitable for economic analysis should result.

LINEAR-PROGRAMMING STUDIES

Last year's Report made reference to the use of linear programming in farm-management analysis. There has been further experimentation with this during the year, although progress on specific studies has not been great. Further programmes for use on the Honeywell 800 computer will be developed, to widen the scope of the linear-programming problems which can be solved using the computer. In particular it is hoped to provide a programme enabling a number of time periods to be incorporated.

Some further preliminary work has been done on linear-programming studies on a mixed wheat/sheep farm in the Wagga district and on a Hunter Valley dairy farm. But both projects have been deferred temporarily, because of other work.

PRODUCTION AND MARKETING OF HONEY IN N.S.W.

Work continued on this general topic for the fifth successive year. A study of the costs, returns, and capital investment in beekeeping was completed. The results were published in two articles in *The Australasian Beekeeper*.

Subsequently, efforts were begun to derive a statistical production-function describing the input-output relationships shown in the results. The preliminary analysis indicated substantial economics of scale; though the basic relationships have yet to be clearly identified.

A survey of honey production from the different flora in southern New South Wales and northeastern Victoria was continued through a second season. Month-by-month summaries of the information were published in *The Australasian Beekeeper*, and a report for the whole season was mimeographed for distribution to co-operating beekeepers and other interested parties.

Further progress was made on the economic analysis of bee-farming statistics in New South Wales for the ten-year period 1954–55 to 1963–64. A number of statistical tests were applied to the data to check the significance of year-to-year differences in the number of beekeepers, number of hives, and honey produced.

No evidence of secular trend was found in any of the series, either for the industry as a whole or for the sub-groupings—ranging in size from 100–200 to 500 or more hives.

Inquiries are now being directed towards finding the possible reasons for the static nature of the industry.

ECONOMICS OF THE POME FRUIT INDUSTRY

Analysis of data collected in the field survey has progressed but the project is still not completed. A report on it may be available before the end of 1966.

FARM MANAGEMENT ACCOUNTING

In this pilot-study in Western Agricultural Region there have been some organizational and management problems but the scheme appears successful and offers potential for expansion.

In conjunction with it, a one-day school in farm-management accounting was held at Wellington in November, 1965. This revealed high interest by practising accountants and farm-management consultants. Over 30 persons attended, representing more than 75 per cent of the accountancy practices and all farm-management groups in the Western Agricultural Region.

PIG PRODUCTION SURVEY

A study has been started in Western Agricultural Region, in collaboration with Division of Animal Industry. It concerns sow and litter performance under commercial conditions. Pig producers throughout the Region are keeping daily records of litter-size and weight at farrowing, weaning, and sale.

So far, analysis of individual farm results indicates that management—as typified by breed and sow and boar, type of housing and ration protein-content—has a significant effect on farrowing-results, and that management plus genetic-potential is more important in subsequent performance.

BANANA MANAGEMENT STUDY

Management problems in the banana industry are now being investigated, at the request of the Banana Growers' Federation and the Australian Banana Growers' Council. The main objective is to examine ways and means for banana-growers to introduce better management methods, to increase net income.

After a recent survey, the Bureau of Agricultural Economics reported that less than one banana-grower in four earns more than $2,000 per annum to cover his own labour and management and provide a return on capital. The survey indicated that the average net farm-income of banana-growers in New South Wales is little more than $1,000 per annum.

A mail questionnaire will be distributed to a large number of growers, to get background information and data for budgeting work. Consideration is being given to a cross-sectional, production-function study as a means of using the data. Consideration is being given also to a continuing farm-record study.

ELASTICITY OF DEMAND FOR BANANAS

A study to determine the price- and income-elasticities of demand for bananas has been started. If the results of this are satisfactory the estimates will be a guide as to feasibility of supply-control and to the rate of increase in future consumer-demand.

The relevant data for a period of twenty-four years have been collected and the estimating-function has been specified.

STUDY OF THE DEMAND FOR EGGS IN N.S.W.

Preliminary work has been done on an econometric study of the demand for eggs in N.S.W. The goals are: to construct demand-models for eggs and egg grades and the various grading systems which have been operating since 1950, and to investigate the ramifications of these grading systems. If the project is successful the results should be of value to egg-marketing authorities.

SHEEP AND BEEF CATTLE GRAZING RELATIONSHIPS

Owing to the drought, it has not been feasible to proceed with this project. But some preparatory work has been done, with a view to resuming the study later.

HAWKESBURY AREA VEGETABLE INDUSTRY

This was a study commenced at the request of the Vegetable Growers' Association. It has been discontinued. Farmer co-operation in keeping necessary records was lacking. Without such records the required type of study could not be done.

ECONOMICS OF COTTON PRODUCTION UNDER IRRIGATION

A major study on this subject was completed and reported on last year. Interest is being maintained in the financial performance of commercial cotton-growers in the southwest.

Records of three crops grown in 1964–65 have been analysed and another three or four are expected to become available. A report will be prepared on all crops for which cost and revenue information is available for 1964–65.

Advisory, Educational, and Extension Activities

EXTENSION SERVICES IN FARM MANAGEMENT

These services continued but were severely restricted through lack of experienced staff. Recent appointees to the Division with excellent academic experience are being trained for subsequent appointment to Regional positions. Some expansion in Regional economic research and extension activities may be possible in the coming financial year.

Further schools and courses in farm management economics for the farming community have been provided. There is very evident demand by farmers and graziers for schools and courses in this subject-matter. More such schools and courses will be undertaken when more trained staff become available.

IN-SERVICE TRAINING IN FARM MANAGEMENT

A training programme for technical extension and research personnel of the Department has also been continued, through short schools.

POLICY ADVICE

The Division continued to provide advice on economic policy affecting agriculture. It also continued to examine and advise on the position concerning imports and exports of coarse grains, protein concentrates, and other farm requisites.

QUARTERLY JOURNAL

The Division continued to publish its quarterly journal, the *Review of Marketing and Agricultural Economics*. Besides the contributions by its own staff, papers from agricultural economists in other organizations in Australia and overseas are accepted. The journal is acknowledged as fulfilling a leading role in Australia by disseminating results of research in farm economics.

OTHER PUBLICATIONS

The *Australasian Bibliography of Agricultural Economics*, prepared by two former officers of the Division, Professor J. L. Dillon, now at the University of New England, and Mr G. C. McFarlane, now Vice-Principal, C. B. Alexander Agricultural College, was submitted to the printer this year. It should be available for distribution in 1967.

The various *Farm Record Books* published by the Department for many years have been completely revised and updated. The new edition should be available for sale early in the new financial year.

The pamphlet *Getting Started in Farming in New South Wales* has been revised in its entirety and at the 30th June, 1966, was almost ready for printing.

A new edition of a processed schedule of contract rates for various farm operations was produced during the year.

LECTURES

At Extension Schools, etc.—Besides organizing the farm-management schools already referred to, officers of the Division addressed several schools organized by the Agricultural Bureau, universities, and other organizations. Officers also addressed various professional societies and other organizations on economic aspects of the rural industries.

Courses at Agricultural Colleges.—The Division continued to provide a full-time lecturer in farm management at Wagga Agricultural College. This lecturer also handles a course on the same subject at Yanco Agricultural College and Research Station.

At Universities.—Two officers of the Division gave short part-time courses in aspects of agricultural economics to students in the School of Wool Technology at the University of N.S.W. One of them also gave a short course on agricultural aspects of regional planning to post-graduate students in the Department of Town and Country Planning of the University of Sydney.

Marketing Boards

GENERAL

Functioning Boards.—The Egg, Rice, Wine Grapes, Lemon, and Tobacco Leaf Marketing Boards constituted under the provisions of the Marketing of Primary Products, 1927–1965, continued to function. The affairs of the Navy Bean Marketing Board are being finalized but winding-up has not been completed.

Amendments to Regulations.—A number of regulations under the provisions of the Marketing of Primary Products Act, 1927–1965, were amended.

Sustenance allowances payable to members of Boards were increased by relevant amendment.

Regulation 45 of the General Regulations was amended to provide for an increased rate of car-mileage payable to members of the Wine Grapes Marketing Board.

Regulation 12 of the General Regulations was amended by including the definition of a producer of broilers for the purpose of any petition or poll under the Act.

Polls and Elections.—Some polls were conducted under the Marketing of Primary Products Act, 1927–1965. These were: the triennial election of producers to the Wine Grapes and the Lemon Marketing Board; and a poll on the question of whether or not a Broiler Marketing Board for the State of New South Wales should be constituted. Broiler growers rejected this proposal.

In the two triennial polls, nominations in each instance did not exceed the required number of producer-representatives. Consequently elections were not needed.

MARKETING REPORTS AND RELATED SERVICES

The Division fulfilled its statutory functions relative to the Marketing of Primary Products Act, 1927–1965, and continued to collect and disseminate detailed wholesale-market information.

Reports covering supplies, quality, price, and price movements at the City Municipal Markets (fruit, vegetables, poultry, fish, and cut flowers), Homebush (cattle, sheep, and pigs), Alexandria, Perry Park, and Sussex Street (grain, forage, and hard vegetables) were provided each day the various markets traded.

Press and Radio Daily Service.—Market information provided by the Division was broadcast daily by the Australian Broadcasting Commission, including regional relays and interstate hook-ups, and by some commercial radio stations. The daily press, periodicals, Federal and State government departments and instrumentalities, producer organizations, etc., were furnished with detailed marketing-information through the *Daily Wholesale Price Quotations.*

Weekly Marketing Notes.—The Division continued to prepare and distribute its *Weekly Marketing Notes.* These comprise detailed reports on stock sales (sheep, cattle, and pigs) at Homebush, prices and supplies of fruit, vegetables, cut flowers, forage, meat, fish, poultry, grain (local and overseas), miscellaneous farm produce and processed products. They also cover cold storage statistics of butter, cheese, and fruit, and include a series of average monthly-prices, regularly prepared from Divisional records on a comprehensive range of farm products.

Monthly Surveys.—Monthly surveys of wholesale and retail stock-feed prices and wholesale-prices of dressed poultry, were continued.

Inter- and Intra-State Supply Trends.—Records of arrivals into Sydney by rail and sea, of various primary products from interstate and intrastate sources, were maintained.

General Information Service.—Numerous requests were received from State and Federal government departments, banks, and private individuals (in Australia and overseas) for information about prices and prospective markets for an extensive range of primary products.

Crop Reviews and Forecasts.—This service was continued. Production forecasts were prepared for wheat, oats, citrus fruits, and broom millet.

The regular monthly survey of *New South Wales Pastoral Conditions* and the *Report on Production Trends* continued to be published.

Meteorological Services.—A Divisional officer continued as Departmental representative in the State Climatological Committee of New South Wales and liaison officer between the Department and the Sydney Weather Bureau.

Comprehensive meteorological records and data are maintained in the Division. Meteorological advice and data were provided for officers of various Divisions of the Department and for members of the public, particularly in relation to the effect of rainfall on various farm pursuits.

Representation in Committees

Divisional officers continued to act as Departmental representatives in the State Nutrition Committee, the Markets Advisory Committee, Gwydir Valley Investigational Committee, North Coast Economics Research Committee, and the Yass Valley Project Technical Committee (the Deputy Chief is Chairman).

A Divisional officer, seconded during the latter part of the twelve months to the Minister's staff, continued to act as Secretary of the Cabinet Sub-committee on Drought Relief and Secretary of the Inter-Department Sub-committee on Drought Relief.

The Chief of the Division was appointed to represent the New South Wales Government on the Australian Tobacco Marketing Board, with the Deputy Chief as alternate member.

The Deputy Chief was president of the Australian Agricultural Economics Society until February, 1966, and continued as a member of the Organizing Committee for the 13th International Conference of Agricultural Economists to be held in Sydney in August, 1967.

DIVISION OF INFORMATION SERVICES

Introductory

The Division engaged in:

- Editing, re-writing, writing for publication;
- Research liaison in terms of advice and writing assistance to research workers preparing matter for science journals;
- Agricultural library services for the Department in general;
- Information and publications' distribution in response to phoned, postal and in-person inquiries;
- Assessment and acquisition of audio and visual aids for extension workers;
- Development of extension workers' skills in using aids, including radio and television;
- Tape recordings for field officers' radio sessions;
- Filming, and cine films library services;
- Show exhibits, and graphics for extension uses;
- Organizational help to the Agricultural Bureau, and promotion of group extension activities through this and other rural groups;
- Organization, and tutorial staffing of short schools and courses for rural people and Departmental officers;
- Information and extension services for rural women;
- Extension service/methods training-schools, and examination of field officers.

Editing Section

The Miscellaneous Extension Literature.—The number of jobs handled continued the steady increase typical of the last 10 years. There are now 1,218 titles in the miscellaneous extension literature, compared with 1,190 a year ago and 922 12 years ago.

At 30th June this year, 318 of the publications are in need of reprinting, after revision. A year ago the arrears totalled 239.

The 318 in need of attention, added to the normal flow of work on periodicals, comprise two years' work. And the backlog is increasing each year.

Of the 318 overdue for reprinting, 118 have been revised by authors and are held pending editor attention; 108 are with authors for revision; and the other 92, not yet revised, are held in the editing section because author attention would probably have to be repeated by the time the items come under editing attention before submission to the printer.

This year 290 items were sent to the printer. The trend of totals for the past 10 years, from and including 1955–56 has been as follows: 131, 165, 127, 150, 178, 232, 189, 169, 287, 320, and 290 (in 1965–66).

The printer this year delivered 240, as against 309 in 1964–65 and 216 in 1963–64. At the close of the year there were 112 items at the printery compared with 140 a year earlier.

Roneoed Press Releases.—These increased to 85, compared to 63 in 1964–65, 50 in 1963–64, and 27 in 1962–63. There having been no public relations officer in the Ministerial establishment for the past year, most drafts had to be processed in the Editing Section before submission to the Minister for release approval.

"Press Copy"—Weekly Sheet.—The 52 issues provided 484 items, including 27 blocks for which stereos were available to newspapers interested. The stereo loan service was not much used. Only 43 loans were sought.

"Dairy Topics"—Periodical at two-month intervals.—The year started with this periodical lagging by one issue from 1964–65. Staff changes and shortage caused further deterioration. Only three issues were delivered, whereas seven was the goal. At 30th June, 1966, the Jan./Feb. issue was expected daily; and the March/April issue was at the printery, for delivery in August.

"Poultry Notes", a quarterly.—Four issues have been delivered.

"Agricultural Gazette of N.S.W.", a monthly.—Copy for twelve issues was prepared on schedule. Ten issues, up to and including the April, 1966, issue, were delivered by the printery. Six were received in the nominal issue-month. From January, 1966, onwards the deliveries lagged. January and February issues appeared in March. At 30th June, the May and June issues were not yet delivered.

Provision of reprints from the *Gazette* had speeded up during the previous year, when almost all were received within three months. This year, delivery periods for reprints have ranged from one to six months and averaged 14 weeks.

The Research Section of the *Gazette* has averaged seven pages per issue, compared to 10 in the previous year.

Flow of other contributions to the monthly 64 pages of the *Gazette* also slowed compared with the previous year, although the space that had to be filled by revised matter from existing leaflets only totalled 28½ pages for the year.

Last year's report recorded that the effective mailing list had been reduced, by revision actions, from 36,790 to 16,232. This year, correspondence arising from those revision actions has been in the vicinity of 300 letters per month. The Department's additions to and deletions from the *Gazette* mailing list have averaged a net *gain* of 150 per month.

"Research and the Farmer"—Regional series.—Issue No. 3, for North Coast Region, went to the printer in June, 1965; final proofs are now with the printer for press. Issue No. 4, for South Western Region, went to the printer in September 1965; first proofs have yet to be received.

"Weeds"—Textbook.—The 1st Edition (6,500 copies) has been out of print for almost three years. Copy for the 2nd Edition will have been completed when work on a new chapter concerned with chemical control of weeds is finished. All will be at the printery by the end of July, 1966.

"Pastures"—Textbook.—The 1st Edition (7,000 copies approx.) first became available for sale in July 1964. Rate of dispersal at $4.20 per copy (less discounts ranging from 10 per cent to 33⅓ per cent to cover the circumstances of various bulk-purchasers, libraries and booksellers) has been very satisfactory. At 30th June, 1966, the Department had only 1,616 copies in store. Meantime, production of revised or new copy for a 2nd Edition is proceeding.

"Trees of N.S.W."—Textbook.—Proofs for the 4th Edition are being held, pending author-supply of photographs because many blocks used in previous editions need replacement.

Research Liaison (Science Publications) Service

Character of the Service.—The Research Liaison Officer, working in close association with the Editor of Publications, continued to show the need for more such appointments. He pursued reader-research into science writings, publications and reprints; pursued also the essential familiarity with Departmental research workers' projects; assisted the writing-up or re-writing/editing of science material in forms suited to particular journals; and, as a regular commitment, maintained a Research Section (research pars and short science-papers) in the monthly *Agricultural Gazette.*

More editing, advisory work than could be handled was accepted even though some requests for advice were declined regretfully. A backlog has developed.

Liaison with Australian Journal of Experimental Agriculture and Animal Husbandry Editor.—On several occasions the Research Liaison Officer worked in concert with the Editor of the *Australian Journal of Experimental Agriculture and Animal Husbandry,* on papers by the Department's research workers. One of their collaborative aims has been improvement on traditional presentation of research-paper material.

Liaison with University Workers.—Liaison with the Agronomy Department, University of Sydney, has, *inter alia,* yielded some research pars by University staff for the Research Section of the Agricultural Gazette.

The Research Section of the "Agricultural Gazette".—The Research Section of the *Gazette* was healthily sustained. The 12 issues totalled 78 research pars; an average of 6.5 per month, compared with 5 per month in the previous year; and nine of the 12 issues included also a research paper.

Briefly, the research pars report progress or results and keep readers aware of the Department as a research force. Subject-matter range improved. There was at least one reference to each major field of the Department's research.

In respect of science papers, as distinct from pars, the aim is to accept not more than one for any one issue of the *Gazette*. Authors are encouraged to submit their science papers to other journals, not to hold papers for possible future *Gazette* use.

Increased Publication of Research Results.—Rate of publication of research papers is increasing. For example, this year 81 identifiable as "research papers" were published, compared with 44 in 1959–60; i.e., almost 100 per cent increase on the rate of six years ago. Of course, allowance must be made for special circumstances. These can increase the rate in any one year; e.g., a weeds conference in 1960–61 attracted 18 papers and lifted the total to 73 for that year.

But a survey of papers in the *Australian Journal of Experimental Agriculture and Animal Husbandry* further indicates the increased rate of publication of research results by the Department's workers. In the first year of that Journal (1961) this Department provided four papers (13 per cent of the total); in 1965, 31 papers (35 per cent of the total).

In accounting for the increased rate of research publication there are such reasons as the greater number of research workers, fruition of research progammes that started in the 1950's, greater stress by research supervisors on the need to publish, and amended requirements for promotion of research workers. But due weight must be placed also on the influence of encouragement and assistance to research workers by the "research liaison officer (science writings)".

Tutorial Advice.—The research liaison officer provided comment on 40 draft papers. Some needed detailed analysis and re-organization, and some a re-write to demonstrate style.

He visited almost weekly the Division of Science Services at Rydalmere, and visited also 11 research stations or research headquarters, to get copy for the Research Section of the *Gazette* and/or discuss readiness of projects for publication. Such special chances as the weeds research agronomists' conference were accepted to lead discussion on science publication. And he presented a paper on "Publishing the Results of Regional Research" at the University of New England seminar on Regional Research in Agriculture.

Work on the "Research and the Farmer" Series.—Last year's report referred to effort devoted to organizing and editing matter for a North Coast Region issue in the "Research and the Farmer" series, dealing with Wollongbar Agricultural Research Station work. The "copy" has been at the printery for more than a year. It is at the corrected proofs stage. The delay has weakened the interest of research workers in using this series for publication. Similar reaction arises from delay of an issue of "Regional Research and the Farmer" for South Western Region, dealing with Yanco and Leeton Agricultural Research Stations' work.

However, in 1965–66 the Alstonville Tropical Fruits Research Station has assisted the future of the series by preparing copy for a further North Coast Region issue. And Grafton Agricultural Research Station staff are discussing proposed contents for yet another issue from that Region.

New Publication Outlets Promulgated.—Increasing experience, in examining the results of work at research stations in relation to existing outlets, is encouraging thought that new publications are needed. Annual Reports from individual Research Stations, if published quickly, could help. The type of "Research and the Farmer" issue produced by Wollongbar Agricultural Research Station in 1964–65, but not yet published, would also help.

Two needs, however, would be (i) financing of timely external publication by parties such as commodity Boards or industry research Councils/Committees, and (ii) increased "research liaison officer (science writings)" staff (present strength: one officer) to aid research stations' staff.

Inquiry Section

Excluding the Home Gardens Advisory Officer's work (see later heading) the inquiry-counter office-assistants handled 42,301 requests; compared with 45,552 in 1962–63, 43,741 in 1963–64 and 41,458 in 1964–65.

Of the 42,301 requests in 1965–66: 8,433 were telephoned compared to 8,033 in 1964–65; 16,042 were postal, compared to 15,502 in 1964–65; and 17,825 were in-person, compared to 17,923 in 1964–65.

The policy first mentioned in the 1961–62 report, of steering rural inquiries towards country offices for subsequent service, has continued its effect. Of continued special interest is the ratio of metropolitan:rural in the year's *postal* requests: 11,018 from metropolitan and 5,025 from rural addresses this year; 11,413 from metropolitan and 4,084 from rural in 1964–65. There were 10,482 postal inquiries from rural addresses in 1963–64.

Publications Distribution

In response to the requests for service, including country officers' needs, the inquiry-counter office-assistants distributed 760,699 publications in the listed range of 1,218 titles, compared with 860, 128 in 1964–65.

The lesser figure for 1965–66 is largely due to several of the most-sought free publications being out of print, e.g., *Feeding for Milk Production, Breeding for Milk Production, Cleaning and Sterilizing Schedule for Milking Machines, Testing Milk and Milk Products,* all of the beef cattle publications, most of the District series of pasture booklets, *Turkey Raising, Duck Raising, Peach Growing, Pear Growing, Apple Growing, Rose Growing, Mushroom Culture, Building Fertility in the Home Garden, Getting Started in Farming, Preserving Fruit and Vegetables,* and others.

The distributed 760,699 comprised 152,970 direct to the public and 607,729 in bulk-parcel responses to the expressed needs of country offices. This reflects the policy of steering rural inquirers towards country offices.

Sales of Publications

Revenue from sale publications approached $8,000, as against about $12,000 in the preceding year. Of the $8,000, most ($6,400 approx.) came from sales of the *Pastures* textbook. Rate of dispersal of the first edition (7,000) of this book since it became available in July, 1964, has been very satisfactory. There are now only 1,616 copies in store.

Non-availability of the new versions of Farm Records Books before the close of the fiscal year has affected sales revenue. Other important sale items not available are the textbooks *Weeds* (2nd Edition), *Trees of N.S.W.* (4th Edition), and booklet *Trees on the Farm.*

Home Gardens Advisory Service

Individual Contacts.—Dealing with home garden, allied, and commercial floriculturalist inquiries of the type that the inquiry-counter office-assistants would be unable to service by resort to the literature range, the gardens advisory officer handled 5,850 requests; compared to 6,432 in 1964–65 and similar totals for each of the preceding three years. Drought and restrictions on metropolitan water-usage kept this year's total down.

Of the 5,850 requests: 1,700 were in-person, 1,059 were postal, and 3,091 were telephoned.

Mass Media.—The gardens advisory officer contributed articles to the weekly *Press Copy* and an article ("Geraniums") to the *Agricultural Gazette of N.S.W.* He also proofed the proposed sale publication "The Home Lawn" he collated in the preceding year. At the close of the year a metropolitan commercial radio station was negotiating for his participation in a regular fortnightly session.

Library Services

International Congress Attended.—Librarian-in-Charge Mr J. Hazell was overseas for October, 1965, in Washington D.C., for the Third World Congress of Agricultural Librarians and Documentalists and to visit some major specialized collections of literature. The project was financed in part by Commonwealth Grant and in part by State funds. His report has been distributed in appropriate places.

Staff Responsibilities Increased.—As previously reported, the Department of Agriculture Librarian-in-Charge is to take charge of combined library services for the six Departments to be housed in the new State Office Block. Approval exists for an establishment of 19 in the State Office Block, including the Librarian-in-Charge, three other librarians, six library assistants, a shorthandwriter/typist, an office-assistant/typist, a female clerk, and a junior attendant; and one librarian and four library assistants for branch libraries of the Department of Agriculture outside the State Office Block. There will also be a part-time librarian for the Veterinary Research Station, Glenfield.

Head Office and Branch Libraries.—Planning for transfers to the State Office Block is well in hand. Some 400 periodical titles were considered for partial or complete transfer to the N.S.W. Public Library, and work flowing from the decisions has almost been completed.

Regular meetings of all personnel to be concerned in the combined library in the State Office Block as well as all branch librarians within the Department of Agriculture have resulted in rationalization of the various collections.

Accommodation at the Agricultural Research Institute (Wagga) branch library has been improved, by a new library. Hawkesbury Agricultural College branch library has been improved by installation of a Compactus unit. A new building has been planned for Wagga Agricultural College branch library.

At the Division of Science Services branch library (Rydalmere) the librarian duties have been expanded to provide for more bibliographical help to officers of that Division.

A recommendation has been made, as yet unsuccesful, for appointment of a full-time library assistant to service Yanco Agricultural College and Research Station, Leeton Agricultural Research Station, and the Regional office (Leeton).

Funds for Books, Periodicals, Newspapers.—The C.R. B4 vote for books, periodicals, and newspapers was increased slightly to $12,000 for 1965–66. But an annual commitment of about $9,000 for periodicals, plus an inevitable carryover of accounts from 1964–65, left only $1,200 for book purchases or new subscriptions to periodicals. Purchasing power was severely inadequate to meet the libraries' services to agricultural research and extension.

Commonwealth financial assistance enabled considerable purchases for Wagga Agricultural College library. Also, $4,000 provided for Yanco Agricultural College and Research Station library enabled a concentrated effort for that institution.

Ordering and Accessioning.—Some 1,415 items were ordered, including multiple copies, new periodical titles, books, and reprints, or photocopies in lieu. Of the total, 333 items and 31 periodical titles were for the central or branch libraries (other than the Colleges) and some country centres. Also, there were 196 items and eight periodical titles for Hawkesbury Agricultural College, 262 items and five periodical titles for Yanco College and Research Station, and 454 items and 17 periodical titles for Wagga College.

Further, 109 books were ordered using Commonwealth Agricultural Extension Grant funds (Project 213). This year the number of books in country office collections financed from the latter source was increased by 118, to 2,260—amongst 87 different locations.

Accessions by the Central Library for the year totalled 15,504 items, compared with 21,993 in 1964–65 and 16,778 in 1963–64. The 15,504 comprised: 776 books; 9,192 issues of periodicals; 4,661 pamphlets (3,959 in series; 496 catalogued; and 206 distributed and/or arranged by subject); and 875 annuals (70 volumes bound; and 805 unbound).

Provision for direct receipt of items at those branch libraries where there is a full-time librarian explains in part the lower figure for central library accessions this year.

Central Library Loans.—Some 31,433 items were loaned. They comprised: 24,358 issues of periodicals circulated (average 468 per week), and 7,075 miscellaneous loans (average 134 per week).

Of the miscellaneous loans, 6,140 were to officers of the Department, and 935 were to other libraries.

Reference Literature Searches.—The central and staffed branch libraries did frequent reference literature searches for Departmental officers, external organizations and the public. The literature search products were regularly listed in the Library Information Bulletins, for possible use by others than the initiator.

Library Information Bulletins.—Twelve of these bulletins were compiled and distributed. These totalled 250 pages and 2,692 items; compared to 258 and 2,769 in 1964–65.

Photocopying Service.—Some 778 jobs, involving 7,259 sheets, were handled; compared with 660 and 5,462 in 1964–65. Equipment of the Departments of Education and Public Works supplied the service.

Binding Service.—Some 204 volumes of unbound periodicals were collated and otherwise processed and tied in preparation for binding. Binding continued in arrears.

Audio and Visual Aids Section

Extension Aids Training Services.—The Extension Officer (Photographic and Allied Aids) and the Extension Officer (Radio) provided training sessions on photography and other aids for television, scripting for television, use of overhead projectors in extension situations, radio speaking and interviewing, and subject-matter organization.

Apart from individual contacts for these purposes, these method specialists provided group sessions—including use of the Closed Circuit Television Unit for "actualities"—in the Northern Region (at Tamworth), in the Southern Region (at Wagga), and at the annual Extension Service/Methods School (at Hawkesbury Agricultural College).

Cine Film Library Service.—Apart from short footages produced or otherwise acquired for use in segments of field officers' television sessions, only three cine films were added to the library. These were "Herd Improvement", "Plywood Silos"—the latter a donation by the Australian Plywood Board Pty Ltd (Qld), and "Horsebreaking the Jeffery Way"—the latter for an in-service training purpose.

Three other films were on order, viz., "Epidemic Foot and Mouth Disease", "Foot and Mouth", and "Outbreak".

Use of cine films by field officers and rural groups has further declined, reflecting the influence of rural television. Only 225 programmes were collated for loan, involving 451 films; compared with 262 programmes, involving 558 films, in 1964–65, and, as recently as 1961–62 some 884 programmes involving 1,913 films.

No effort has been pressed towards replacing what are now aged and worn projectors in many districts. At this stage of the effects of rural television the weight of use of funds seems better placed on other types of extension equipment.

Best use of cine films at this time is occurring in the special teaching-situations provided by short-term schools and courses.

Cine Film Production.—Six film-footages on aspects of drought feeding, lucerne production, and row-crop seed production, filmed in Western and Mid Western Regions in June, 1965, were processed and edited for use in Western Region's television sessions.

A film-footage on handling of export pome fruit in the Port of Sydney was made at the request of Division of Horticulture for use in Western Region's television sessions.

Six film-footages made by Channel 8 at Orange for Western Region's television sessions have been purchased in duplicate, for possible use by field officers elsewhere.

Filming of the "Rapid Development Whole-Farm Feed Year" project on a farm at Uki, on the north coast, is proceeding. This will continue for 2–3 years.

In collaboration with Department of Primary Industries and the National Film Unit arrangements are in hand towards production of a film (or series) on drought. Sectional headings were prepared by this Department for the Commonwealth authorities. Field-filming opportunities were organized for and well-used by the National Film Unit in various Regions in recent months.

Field Officers' 35-mm Protography for Extension.—A total of 19,660 photographs by field officers passed through the Photographic Aids Section for processing and return to the field as 35-mm slides for extension uses. The 19,660 comprised 12,940 colour and 6,720 black and white slides.

Since January, 1966, all of the processing and mounting of black and white photography has been done in the Department's own work room, instead of by a contractor. This has yielded a much improved service to field officers, in quality of slides and promptness of return.

Special Purpose Photography.—Division of Information Services' Photographic Aids Section this year made 2,670 reprints; in 250 separate processing jobs. The printing included such specials as a 13 ft x 7 ft mural enlargement for the Royal Show display, as well as numerous transparency enlargements 12 in x 10 in for displays.

Some 89 camera assignments demanding special skills were fulfilled. These included copy-photographs, specimens, portraits, and equipment-photographs.

A helicopter flight was undertaken to get aerial photographs of farm dams and tanks in various farm-water harvesting schemes, for use in the Royal Show display.

The photographic library was well used; 339 loans of films and negatives in providing matter for publications. Some loans were to other than the Department's Publication Section. Forty-two selected negatives were loaned to the Visual Education Centre of the Department of Education for film strips on the Hunter Valley. Some loans were to newspapers.

Farm Radio.—Regional Publicity Officers' reports show that at least 4,530 farm radio sessions were provided by field officers during the twelve months; at least 450 hours on-air. Forty-two of the State's rural radio stations continue to broadcast farm programmes wherein the Department's officers or their material are the feature.

Tape-recording equipment provided from Commonwealth Grant funds has been a major factor in assuring the regular fulfilment of field officers' commitments.

Head office tapes, 125 for the year, again comprised only a minor percentage of the Department's use of radio in extension. This is consistent with the long-standing policy of encouragement of "local material for local people, by local officers using local facilities".

Of the 125 head office recordings, about two-thirds were Women's Extension Service items—there being no Women's Service officer stationed in country areas.

Television Usage.—Regional Publicity Officers' reports show an aggregate of at least 223 television sessions provided by field officers for rural TV channels. Commercial TV channels at Orange, Wagga, Canberra, Leeton, Coff's Harbour, and Lismore have been the venues.

The current general assessment of television by extension workers is that it is an outstanding information-provider and public relations medium; but extremely demanding of preparation and time, for competitive quality. Re-assessments of the place of television, because of its demands, are proceeding in each Region.

Display Artist/Designing Services.—The output included the Department's display ("Farm Water-Harvesting") at the Royal Easter Show; assistance to country officers staging displays at West Wyalong, Lismore, Orange, Grafton, and Bega; maps in line and colour; technical illustrations—graphs, diagrams, and line and wash drawings for publications; signs used at country shows or field days; titles for films and articles; photograph-retouchings for block-copy; cards, tickets, charts, and drawings for lecture aids.

Agricultural Bureau and Allied Group Activities

Twelve More "New-Look" Branches of the Bureau.—"New-look" branches of the Bureau were formed at West Wyalong, Cowra, Hastings Valley (Wauchope), Goulburn, Wellington, Millthorpe, Merriwa, Coonabarabran, Boorowa, Mudgee, Bathurst, and Dungog. These inaugurations were consistent with the policy described in last year's report: branch establishment for a major or near-major area rather than a minor locality, and conduct of branch activities by a management committee which promotes three or four big events per year rather than monthly or otherwise regular meetings of the membership.

Bureau Branch Activities.—The trend to few branch meeting for miscellaneous lectures, discussions, or films continued. There was a more than compensating promotion of special-feature meetings dealing with matters of immediate concern. Typical of these were the numerous big meetings on "the wool reserve price plan", "water resources", "drought feeding" and the like. The trend within branches to reserve efforts for events airing major subject-matters seems sure to characterize future Bureau activities.

Field days still figured prominently in branch programmes. Many were promoted largely for local members' interest but an increasing number were designed to draw attendances from wider areas. As examples: Dorrigo branch organized a machinery field day with drew 500 people; Oakdale and Werombi branches arranged orchard field days attended by over 100 from several orcharding areas; and Tumbi Umbi branch arranged a tomato field day which drew 70 from central cost vegetable areas despite appalling weather on the day.

Branch Affiliations with their State Advisory Council.—Only 132 branches affiliated financially with the Council, eight less than in 1964–65 and 27 less than in 1963–64. This is consistent with the trend shaped by policy, reported earlier, towards cessation of branches in minor localities and inauguration of bigger branches which draw memberships from wide areas.

A pleasing feature of the latter is that some of the new branches are based on areas that for years past had shown little interest in the education-type activities typical of the Agricultural Bureau. In enrolling members these are drawing upon a wide cross-section of the rural community. In membership numbers too they are impressive. For example: Inverell branch came into being in 1964–65 with more than 100 but in 1965–66 has increased to 319 members.

Advisory Council Concentration on "Bureau Development".—The State Advisory Council this year comprised 13 councillors from nine of the ten Bureau Regions (only Northern Region did not have a single representative), two woman councillors, and the State President and immediate-past President, a total of 17. Their attendances for the four meetings held averaged 82 per cent of the possible. They also gave their personal time freely in promoting Bureau services in the respective Region.

The Councillors this year concentrated on Bureau development of the "new-look", i.e., branches in larger centres and promoting three or four major educational events per year. The new approach has kindled some problems. These mainly concern ability of staff to cater adequately for expressed needs of new branches. Councillors as well as the organizing staff provided by the Department are anxiously watching the rate of formation of new branches, relative to continued ability to sustain quality in servicing the needs likely to be expressed.

External Lecturers, Demonstrators, Advisers.—Department of Agriculture officers continued to be the most frequently used at Bureau functions. Many also notably assisted local branches or councils by advice on organizational or promotional matters.

However, only by increased use of speakers from universities, commercial firms, banking institutions and other external sources could the numerous Bureau promotions be serviced.

Greater income within the Bureau units, from higher membership fees and from fees imposed on enrollees for schools and courses, has been a major factor. The income enabled such developments as air transport for speakers otherwise unable to spare enough time away from normal duties; travel and sustenance expenses; and, in some cases, fees for speakers.

Major Conventions/Field Days in Regions.—Ten major Conventions or Field Days were held under Bureau Regional/Divisional/District sponsorship. These were the North Western Convention at Goolhi (attendance 70), another North Western Convention at Wallabadah (120), Mid Coast and Hunter Convention at Paterson (175), Clarence Field Day at Nana Glen (75), Mid Western Convention at Parkes (250), Cumberland-Central Coast Convention at Kulnura (80) and Field Day at Arcadia (100), Monaro and South Coast Convention at Jindabyne (120), and Richmond-Tweed Convention at Wollongbar (140) and Field Day at Nimbin (150).

The 41st State Congress of the Bureau.—The resident-attendance of delegates for the three days' educational sessions of the State Congress at Hawkesbury College in August, 1965, was only 131, the lowest on record. Drought accounted for this.

The programme featured a major symposium on "The Challenge of Drought". This was presented by the N.S.W. Division of the Australian Institute of Agricultural Science.

Bureau Schools and Courses.—Of the 149 short schools or courses for which the Department of Agriculture was this year a major element from the organizing and/or staffing angle, the Agricultural Bureau was also a major element for not less than seventy-five. In these 75 were 19 of the 32 homemaker schools arising from Women's Extension Service work.

The diversity of topics, the places and the enrolled attendances (mostly fee-paying) are indicated in the following summary of 1965–66 Agricultural Bureau schools and courses:

Ten "Soils and Botany" Courses: Each a series of five lectures, a night per week for five weeks. Promoted by the Bureau areas as named, with attendances as shown in parenthesis: Merriwa (37), Arcadia (43), Bingara (55), Boorowa (40), Coleambally (40), Dubbo (61), Forbes (25), Inverell (84), Millthorpe (32), and Wellington (36).

Three "Sheep Nutrition" Schools: Each of two days' duration; Coonabarabran (35), Forbes (65), and Millthorpe (28).

"Soil Science" School: A three-day school promoted by Ariah Park branch; 41 attended. This was the first such school and its success has indicated that more are likely.

Two "Pasture Production and Utilization" Schools: A two-day school at Murrumbateman (50) and a one-day school at Coonabarabran (37).

Three "Pastures" Schools: A two-day school at Mullion Creek (41) and Dubbo (71), and a one-day school at Fairy Hill (35).

"Fodder Conservation" School: A two-day school at Bingara (30), with 50 or more at associated field demonstrations.

"Vegetable Production" School: A two-day school at Bathurst (43).

Five "Irrigation" Schools: For three days at Forbes (64), two days at Inverell (100), two days at Narromine (108), one day at Bilpin (38) and at Oakdale (63).

"Irrigation" Course: One night per week for six weeks, at Wyong (40).

Three "Fertilizer" Schools: Two days, at Baradine (46) and Inverell (120), and one day at Gunnedah (50).

Two "Drought/Supplementary Feeding" Schools: One day each, at Bathurst (150) and Dubbo (120).

"Sheep and Cattle Reproduction" School: Two days, at Merriwa (70).

Two "Prime Lamb Production" Schools: One day each, at Lake Cargelligo (75) and West Wyalong (90).

"Wool Production and Marketing" School: Two days, at Boorowa (37).

"Cattle Diseases and Management" School: One day, promoted for Wauchope by Hastings Valley branch (65).

Two "Dairy Cattle Health" Courses: Five weeks, one night per week, at Bowraville (28) and Coff's Harbour (27).

Three "Farm Management" Schools: Four days at Bombala (27); two days at Mudgee (36); and three days at Inveralochy (40), sponsored by various bodies in association with the Southern Tablelands Divisional Council of the Bureau.

Seven "Tractor Maintenance" Schools: Each a one-day event, at Coleambally (25), Browns Creek (28), Dungog (21), Hampton (27), Morpeth (43), Mullion Creek (18), and Singleton (16).

Three "Welding" Schools: One day each, at Carabost (18), Lankeys Creek (20), and Lowther (15).

"Rural Finance" School: The first of its kind; at Muswellbrook (159).

"Summer Crops" School: A one-day school, at Coonabarabran (110).

"Leadership" Schools (4): A three-day school at Baradine (24); and provision of teaching staff for three other three-day schools for which the organizing was done by C.W.A. Groups—at Gilgandra (41), Narrandera (44), and Ingleburn (41).

"Public Speaking and Meeting Procedures" School: A one-day school as Gosford (78), organized by a C.W.A. group, but staffed by the Bureau and Women's Service sections of the Division.

Nineteen of the Women's Extension Services' Thirty-two Homemaker Schools: Their enrolled attendances ranged from twenty to eighty-three, and they accounted for 691 of the 1,199 women who attended Women's Extension schools this year.

Beef Cattle Breeders' Competition 1965–66.—This competition, conducted in association with the Rural Bank of N.S.W., drew 118 entries. As usual, it gave rise to extension occasions. Prominent in these were the field days associated with District and State Final judgings. These draw at least 1,000 farmers and pastoralists.

Women's Extension Service

Schools.—Thirty-two Homemaker Schools were conducted on locally selected subject-matter. Each was a one-day school. Their enrolled attendances ranged from twenty to ninety-two, and aggregated 1,199. Nineteen of the schools were in association with Agricultural Bureau branches, and the thirteen others were for the Country Women's Association or other rural groups.

The Women's Extension Service tutored 18 of the 32 schools, and organized external tutors for the 14 others. Those for which the W.E.S. were tutors comprised "Home Furnishing and Decoration" (7 schools), "Planned Work, More Leisure" (2 schools), "Personality with Poise" (4 schools), "Understanding Ourselves" (2 schools), and "Steps to Better Dressmaking" (3 schools).

External tutors were organized for "Home Nursing" (7 schools), "Hair Care" (2), "Wardrobe Planning" (1), "Pattern Adjustment" (1), "Floral Art" (1), "Cold Climate Gardening and Garden Planning" (1), and "Steps to Better Dressmaking" (1 case).

The W.E.S. also contributed tutorially to four "Leadership" schools, the Department's "Extension Service/Methods" in-service training school, and the Australian Broadcasting Commission's Training School for Afro-Asian rural broadcasters.

Women's Sessions for Congress, Conventions, Field Days.—Fifteen sessions for women were organized for particular occasions including the 41st State Congress and seven Regional Conventions or Field Days of the Agricultural Bureau. Subject-matters of 6 of the 15 sessions were directly provided by the W.E.S.

Press, Journals, etc.—Women's interest articles were contributed for 50 issues of the weekly *Press Copy;* and 33 news releases about schools, conventions, and field days were prepared for Regional publicity.

Thirteen articles were prepared and six others were secured from external contributors for the Farm Home section of the monthly *Agricultural Gazette.* Eighteen "filler" notes were prepared for the same journal.

Home Freezing of Foods, a 58-page booklet prepared in 1962 was delivered by the printer in November, 1965. Proofs of a revised edition of the *Jam Making* booklet were checked. Reference handbooks for *Home Nursing* schools and *Treatment of Poisoning* were produced.

Radio and Television.—Eighty-five recordings were made for radio usages; 71 of these were publicity releases for forthcoming schools. Monthly dispatch of tape-recorded talks/interviews to Regions for possible use in their farm radio sessions was discontinued without a protest. The W.E.S. contributed to 1 rural television session.

Extension Service/Methods Training; and Examinations

Division of Information Services provided four of these training schools:

- The two-week residential school for 45 Department of Agriculture and Junior Farmer Club officers;
- A one-week residential school for 2nd-year undergraduates in Rural Science/Agricultural Economics, University of New England;
- A five-day course on communication for CSIRO Division of Plant Industry officers;
- A Television Training School for North Western Regional officers; and assisted others.

A Regulation 124 Higher Salary Grades examination paper on Agricultural Extension Service was set and marked by the Chief, Division of Information Services for Department of Agriculture field officers and J.F.C. supervisors. Papers were set and marked also for the University undergraduates.

The Department's Volume of Short Schools and Courses

In 1965–66 the short schools and courses wherein the Department was a major organizing and/or staffing force reached a record total of 149. The previous record was 132, in 1964–65. Number and range could be still greater if resources were sufficient to cope with the demand.

The Division of Information Services Special Extension Officer on group work has compiled as complete a tabulation as was possible with information that has come his way, about the 1965–66 schools and courses. The tabulated details indicate the location, attendance, duration, subject-matter theme, and the organization(s) primarily associated. The tabulation comprises *Appendix III* to this Report.

The following are some interesting dissections from the tabulated data:

> Of the 149 schools and courses, 134 were *schools* of from one day to as many as 11 consecutive days, and 15 were *courses* requiring the enrollees to attend one night per week for either four, five, or six weeks. There were 75 x 1-day schools; 16 x 2-days; 15 x 3-days; 12 x 4-days; 13 x 5-days; one x 10-days, and one x 11-days.
>
> Not less than 133 of the 149 schools and courses were at country sites, most of them arranged and financed by a collaborating local association or committee; whilst 11 were at Hawkesbury Agricultural College, three at Wagga Agricultural College, one at Yanco Agricultural College and Research Station, one at Narrabeen National Fitness Camp and one at the University of New England, Armidale.
>
> In the total of 149 were 75 Agricultural Bureau schools and courses and 32 Women's Extension Service schools (including 19 of the 75 Agricultural Bureau promotions) wherein Division of Information Services was a major force. Also, the four schools on extension methods or communication principles were primarily Division of Information Services commitments.
>
> Thus, Division of Information Services was heavily involved in at least 92 of the 149 schools or courses wherein the Department this year was a major element. Over and above this was assistance given, considerable in some cases, to parts of the Department in respect of other schools; such help as in planning the programme, selecting and securing speakers, publicizing, securing enrolments, producing handbooks and, in some cases, part-staffing.
>
> Attendances for the 149 schools and courses aggregated near to 6,400. Of these, 1,200 were in the homemaker schools.

Diversity of the subject-matters of the schools and courses is illustrated by the following drawn from the range of titles:

> "Public Speaking and Meeting Procedures"; "Soil Science"; "Soils and Botany"; "Farm Management"; "Pasture Production and Utilization"; "Pasture Improvement"; "Winter Pastures"; "Weeds"; "Summer Crops"; "Cereal Production"; "Fertilizers"; "Irrigation"; "Prime Lamb Raising"; "Sheep Nutrition"; "Sheep and Cattle Reproduction"; "Wool Production and Marketing"; "Dairy Cattle Diseases and Management"; "Dairy Cattle Health"; "Dairy Cattle Husbandry"; "Dairy Farming"; "Horticulture"; "Drought Feeding"; "Fodder Conservation"; "Supplementary Feeding"; "Stock Nutrition"; "Tractor Maintenance"; "Welding"; "Rural Finance"; "Turkey Production"; "Beekeeping"; "Pig Raising"; "Vegetable Production"; "Sheep and Agronomy"; "Poultry"; "Dairy Science"; "Dairy Factory Apprenticeship"; "Food Factory Foremanship"; "Milk Grading"; "Herd Recording"; "Dairy Factory Technology"; "Television in Extension"; "Universtiy and College Trainee Induction"; "Extension Service Principles and Methods"; "Communication"; and the numerous Homemaker topics indicated in an earlier section of this report.

Nine of the schools were of in-service training character for Departmental officers or trainees. Thirteen of the schools were for industry operatives; most of these, dairy factory operatives.

REGIONAL EXTENSION SERVICES

General

Progress of decentralized administration of extension services, through the defined nine Agricultural Regions, continued.

The Chief of Regional Extension Services continued to be responsible to the Director-General for administration also of the Commonwealth grants affecting the efficiency of extension work. These grants, the Agricultural Extension Services Grant (A.E.G.) and the Dairy Industry Extension Services Grant (D.I.E.G.) are direct to the Department of Agriculture through the Commonwealth Department of Primary Industry. In the past year they have totalled $328,000. Since their inception, 1949 in the case of the D.I.E.G. and 1952 in the case of the A.E.G., the grants have aggregated an expenditure of about $3,841,755 on extension services in New South Wales.

The Chief of Regional Extension Services is Chairman also of the New South Wales Committee on Drought Relief (see p. 10), and a member of the New South Wales Flood Relief Committee and of the New South Wales Bush Fire Committee (see p. 11). His role in each of those Committees has *inter alia* provided direct, essential linkage with the field staff throughout the nine Agricultural Regions. Their field services have inevitably been needed and drawn in by the Committees in the course of drought-, flood- and bushfire-relief activities.

PERSONNEL IN REGIONS

Numbers.—As at 30th June, 1966, of the 502 Department of Agriculture officers in country districts for advisory and regulatory services to primary producers, 449 are within the Regional administration system.

Agricultural officers in the nine Regions, excluding clerical and office-assistance personnel, now total 363; 14 more than a year ago. There are 86 clerical and office-assistance staff; seven male and 79 female officers.

Staff shortages continued as a limiting factor on services. There were vacancies, in established positions, for three District agronomists, eight District livestock officers, three District fruit officers, and five Regional economics research officers.

Some New Positions.—Two new types of position were created this year: Weeds Officers (2) and Locust Control Officer (1).

Additions to the number of established positions included two new District agronomist positions, three new District sheep and wool officer positions, one new Regional economics Research officer position, one new District piggery officer position, one new Regional agricultural machinery officer position, two new District fruit inspector positions and a new herd organizer position. Since new Districts were defined to provide for these appointments, there were some inevitable changes in former boundaries of Districts and Regions.

Male Clerks for Regions.—There is now a Male Clerk (Grade I) at each Agricultural Region's headquarters, except that the clerk at Tamworth (Northern Region) also performs the duties at Gunnedah (North Western Region) and the clerk at Orange (Western Region) also performs the duties at Cowra (Mid Western Region). This completes the current programme of appointment of graded male clerks to Regional headquarters.

Appointment of the clerks has enabled many accountancy procedures formerly done at Head Office, Sydney, to be done regionally. Each Region has an Advance Account ranging from $3,000 to $5,000. This enables local payment of travel-expense claims, payments for goods and services, on local purchase orders, and office rentals. An example of the extent of this facility is that one Region passed a total of $30,000 through the Advance Account this year.

Also, revenue collections proceed Regionally, e.g., fees from herd recording, seed certification, potato licences, apiary registrations, and sale of publications. These ranged in totals from $5,000 to $10,000 per Region during the year.

An important function of the respective Regional clerk has been to visit District offices throughout the Region, supervising aspects of office administration including plant-records (Commonwealth Grants' plant in the Regions has a value of $350,000), postage and rail stamps, petty cash accounts, attendance-books and leave-records. *Inter alia* the clerk has been able to advise local officers on procedures in respect of requisition-preparation, orders, claims, and other administrative matters that involve technical staff as well as rural office-assistants.

OFFICER-TRAINING IN REGIONS

University and College Trainees.—Some 232 trainees of this Department are enrolled at universities and agricultural colleges, including the intake of 120 for 1966. (Of the total 27 are financed by Commonwealth Grant funds.) During the university or college phase of their career the trainees have to spend, from the Department's viewpoint, twelve months in gaining practical experience. A substantial part of this is spent in Agricultural Regions. There they are associated with various extension and regulatory officers. In the past year, 31 trainees were attached to Regions.

Training In-Service.—To speed up the development of young officers with potential for extension work, the Department continued to use the system of training in Regions. In the past year 25 young officers were attached to Regions for this type of training. The young officer is given a period, up to twelve months, of intensive training in one or more Regions. There he is attached to experienced extension officers—officers of other subject-matter Divisions as well as the Division to which he belongs.

The training and actual experience in all aspects of extension work and administrative procedures has included organizing and conducting schools and field days, broadcasting, writing press articles, answering inquiries, preparing reports, judging competitions, and an introduction to the overall duties of an officer-in-charge of a District office.

Special Study Opportunities.—A number of Regional officers have undergone specialized forms of training or pursued certain courses of study, some in overseas countries.

The Mid Western Regional Supervisor (Cowra headquarters) is this year attending a one-year post-graduate Diploma course in extension at Brisbane University. The Mid Coast and Hunter Regional Supervisor (Maitland headquarters) and the Senior Agronomist at Lismore (North Coast Region) completed that course last year.

The Western Regional Supervisor (Orange headquarters) is now on a four months' overseas study-tour of extension services in Western Europe, the United Kingdom, and North America, and, amongst other things, has attended the 14th International Seminar in Rural Extension at the University of Wageningen, The Netherlands.

The Southern Region's Economic Research Officer (Wagga headquarters) has continued his study-leave, on a Fellowship at Wye College, University of London, undertaking courses associated with agricultural economics and farm management, both at Wye College and the London School of Economics.

The Northern Region's Economics Research Officer (Tamworth headquarters) continued the study-leave granted in September, 1963, at the University of Illinois. He has been awarded the M.Sc. degree in Agricultural Economics at that University.

The Northern Region publicity officer (Tamworth headquarters) is an external studies student for the B.A. degree of the University of New England, Armidale. He, and the Northern Region Supervisor, also undertook the reading improvement course at that University.

The Griffith District agronomist from the South Western Region (Leeton headquarters) is in the U.S.A. for a special study of cotton production. Another District agronomist from that Region is doing the B.A. degree course at the University of New England.

OFFICE ACCOMMODATION

Office accommodation continued to improve. Regional headquarters as well as District offices in the Regions have in general reached a high standard. But further appointments in the past year and anticipated appointments have raised the need to expand at some of the centres.

Albury.—New Government offices are practically complete. Occupation is expected to occur in August, 1966.

Cooma.—A new office in a conveniently located relatively new building was acquired for the sheep and wool officer appointed to Cooma after a lapse of about three years.

Cootamundra.—New Government offices were occupied this year and gave needed relief from the former cramped conditions.

Coonabarabran.—The accommodation there is unsatisfactory. Negotiations are under way with the Pastures Protection Board. This Board's plan for additions to the present building has been accepted by the Department, but finance is required.

Cowra.—The new Government offices were completed, and occupied by Regional headquarters staff in January, 1966.

Griffith.—Accommodation for the eleven officers stationed at Griffith is inadequate. Pending a possible new Government office little can be done—because shortage of office space is general at Griffith.

Gunnedah.—Additional office space was secured in part of the adjacent building previously occupied by the Soil Conservation Service. The four added offices enable all staff at Gunnedah to be suitably accommodated. Also, a sound-proof radio-recording booth has been built and this provides as well a photographic dark-room.

Goulburn.—Present accommodation is satisfactory but in due course these Regional headquarters will move into a new Government building to be erected in Goulburn. All Government Departments will be at that centre.

Inverell.—A Government office-building is being erected. The full needs will be met when the building is completed later this year.

Kyogle.—The office is reasonable but the building is very old and the facilities belie the policy of modern office-provision for public Departments in country towns.

Lismore.—Recent and proposed added appointments, totalling five officers, will greatly overtax existing accommodation in the North Coast Regional headquarters at Lismore. Plans for new premises on the site are said to be well advanced, but a new building is not expected for at least another year.

Moree.—Plans have been drawn for a new Government building. This will provide suitable accommodation.

Murwillumbah.—There are two separate offices here. One of them is adequate for its purpose. The other has reached saturation point. Storage space for equipment and stores is quite inadequate.

Tamworth.—Completion of a new Government building is expected in August, 1966. But it will be necessary to acquire further space, for staff not contemplated during the planning.

Wagga.—Extensions to the Government building are planned. These will provide more space for Southern Region's headquarters staff. The present accommodation, two floors, will extend to four floors, a need foreseen when the building was constructed ten years ago.

REGIONAL ADVISORY COMMITTEES

An Advisory Committee, in each Region, is appointed by the Minister. The Regional Supervisor is Chairman. The Committee suggests and advises on ways and means of improving production and efficiency in the Region.

In May, 1965, the Minister requested each Committee to give special consideration to drought problems and to offer suggestions. Excellent ideas resulted. All were submitted to the N.S.W. Standing Committee on Drought Relief. Some of the meetings were attended by the Minister.

The Advisory Committee in the Southern Region recommended appointment of a fodder conservation officer. This helped in the appointment of a Special Agronomist (Fodder Conservation) in Division of Plant Industry. This Committee also instigated a detailed survey of fodder stocks in the Southern Region, to assess availability of fodder for trucking to drought-stricken areas.

The Minister also sought the interest of the Advisory Committees in connection with the then pending legislation on exotic diseases of livestock. Besides strongly supporting the proposed legislation, the Committees without exception assisted Regional staff with ideas to publicize technical information on exotic diseases and the drastic effects any of these could have on livestock production if it entered the country.

REGIONAL WATER- AND SOIL-TESTING

Through the drought, the potential of new or unusual sources of water for livestock or for irrigation created increased demand for water and soil testing by Regional offices. The total of tests this year was 4,174; 666 more than in the previous year.

The decentralized testing-service proved invaluable to hundreds of landholders in a variety of ways. In one case a daily check was made, during a critical period, to determine salinity-status of tidal reaches of three important rivers used for irrigation. The constant checking prevented serious damage to soil and crops.

In a number of cases, landholders were saved heavy expense by prompt local testing of water from new bores or other sources, to determine water-quality before more was spent on the respective project. Many such projects were shown to be useless for irrigation.

MASS MEDIA OF EXTENSION AND PUBLICITY

Press.—Releases to newspapers, one of the best media for agricultural extension, totalled about 2,000 from Regional offices. Some of the releases were of a "news-pack" type, conveying more than one topic. Also, special newspaper-supplements were planned and prepared by Publicity Officers and Regional staff in conjunction with a number of country newspapers. Some dealt with specifics such as lucerne or pigs or irrigation. Others covered the whole range of agricultural and livestock production of the particular area.

An extract from this year's Sommerlad Award (Country Press Association) is quoted as an indicator of the quality and value in the newspaper supplements:

> "A special commendation, not provided for in the conditions of the competion, is given here to a particularly interesting, and certainly outstanding, forty-page supplement entitled 'The North West, Future Food Bowl of the Nation', from the *Namoi Valley Independent*, Gunnedah, the *North West Courier, Narrabri*, and the *North West Champion*, Moree.
>
> "This supplement was published jointly in the three offices of these newspapers, in association with the North West Regional Office of the Department of Agriculture with Headquarters at Gunnedah. With text and photos, the supplement presented an abundance of information concerning the background to, and current developments in, the agriculture of the North West. Special feature articles on wheat, cotton, diseases, fertilizers, farm management, research, pastures, farm mechanisation, irrigation and associated topics were included and these were well illustrated.
>
> "The cover was an impressive montage.
>
> "This was a supplement which might well have been distributed beyond the areas served by the participating newspapers."

Radio.—The total of radio broadcasts was near 5,000 but the total time dropped by some 25 per cent to about 530 hours. This reflected a trend away from what are now assessed as "lengthy" 15-minute sessions, covering a wide range of material, to short topical-items of three to five minutes duration. The latter allowed broadcasts in better "time-slots", such as before and after radio station news bulletins. Despite the impact of rural television, radio is still a vital channel for agricultural extension.

Television.—Some Regions commenced television commitments. Other Regions curtailed or terminated their commitments.

Currently, four Regions are presenting regular television programmes. Two others are providing "spot" programmes. Due to overlapping of channel-viewing areas and Regional boundaries, some Regions have arranged joint-use of time allocated. The Regional and District officers aggregated a total in excess of 200 television sessions this year. Their total of time on air was about 100 hours, an increase of 60 hours compared to the previous year.

As in the case of radio time, none of the television time was bought by the Department.

Films, and Film-Footages for Television.—Some television stations generously provided equipment and cameramen to enable production of cine film-footages, not only for local but for possible use in extension work in other areas. Film-footages on "Cloud Seeding", "The Birth of a Research Station" (Orange), "The Work of a Veterinary Inspector" and "Our Daily Milk" were produced in this way. Film-footages on a variety of topics were also produced in collaboration with the Photographic Aids Section of the Department's Division of Information Services. Also the Commonwealth Film Unit was assisted by Regions to acquire appropriate matter for a contemplated drought-film (or series) at the request of the Australian Agricultural Council.

Publications.—Publicity officers and Regional technical staff worked together to prepare specialized publications. These included *Farmers' Newsletters*, issues in the *Research and the Farmer* series and, in one Region, a monthly *Guide for Graziers* conveying topical advice.

Departmental, miscellaneous literature was in constant demand. At most regional centres, leaflet dispensers provided a convenient distribution of topical literature. Typically, in one Region the turnover of miscellaneous publications totalled 28,000 for the year.

Schools, Conventions, and Field Days.—Over 350 functions by way of short schools and field days were in association with Regional effort. Attendances ranged from a few persons, for the smaller occasions, to over 1,000 at the major field days.

Most of the short schools were of one or two days' duration, but some continued for four to five days. A few were of residential type.

The continued drought created the need and demand for additional instruction on drought-feeding. Many of the schools were specifically for this purpose. In one Region a series of eight one-day sheep nutrition schools, at various centres, was promoted.

Many of the schools and field days and conventions held in Regions were sponsored by branches of the Agricultural Bureau of N.S.W.

CONFERENCES

Regional Supervisors' Conference.—The biennial Conference of Regional Supervisors was held in the Department of Agriculture, Sydney, in March, 1966. Besides discussion of many administrative matters, including new procedures arising from appointment of clerks to Regions, the opportunity was taken to confer with Chiefs of Division and Heads of Branches on matters of mutual interest.

Conferences of Officers in Regions.—It has been customary to hold a specially-programmed Conference of officers in each Region at three-year intervals. These Conferences provide for re-assessing extension programmes within the Region as well as discussion of a wide range of technical and administrative matters involving attendances by particular authorities.

Three such Conferences were held this year; for South Western Region, at Leeton, for South Coast and Tablelands Region, at Goulburn; and for North Coast Region, at Lismore. Each was addressed by senior officers of the Department including the Director-General and Deputy Director-General.

Staff Meetings in Regions.—Monthly meetings of staff stationed at the headquarters of each Region have provided for dissemination of information on a wide range of matters, clarification of new instructions, free discussion of and suggestions for improved work-methods.

Civil Defence Conference.—Six officers of the North Coast Region attended at Lismore in March, 1966, a Civil Defence Conference dealing with the evacuation and welfare of evacuees from major cities. Regional officers in general have taken an active role in regard to civil defence matters.

Co-ordinated Extension Services

The scheme, established in 1952 by the then Food Production Council, to co-ordinate all extension services in this State, was continued. This scheme encouraged all extension officers, not just officers of the Department of Agriculture, but field valuators of the Rural Bank of N.S.W., and field officers of the N.S.W. Soil Conservation Service and of the N.S.W. Milk Board, to give co-ordinated general agricultural advice to primary producers, provided the recommendations were consistent with Department of Agriculture advice. Previously, only officers of the Department of Agriculture gave this type of advice.

The scheme has continued to function. Officers of other Departments are given the opportunity to keep up-to-date on changes in recommendations by receiving copies of all new or revised publications issued by the Department of Agriculture. Also the officers collaborate in the field and many have assisted at the schools and field days promoted in Regions.

Notes Selected from the Reports of Specific Regions

MID COAST AND HUNTER REGION

The Drought.—The Mid Coast and Hunter Region was one of the worst-affected areas, and was still suffering severely at the end of the year under report. Rainfall in coastal districts was the lowest on record.

The Paterson and Williams Rivers, normally contributing 40 per cent of the total Hunter Valley discharge, ceased to flow. This was late in 1964 and they remained dry until July, 1965. Flow ceased again in September/October, 1965, and was only intermittent or low until early 1966. Flow in the Hunter River was maintained, but only at a low level and this by discharge from Glenbawn Dam. The Dam at the close of the year under report was down to 12 per cent of its capacity.

A survey of rural industries in this Region for the twelve months indicated an aggregate loss exceeding $6 million. Farmers in the Maitland Pastures Protection District alone spent $1,600,000 on fodder.

From generous contributions by Victorian farmers under the "Operation Goodwill" gift-fodder scheme, needy farmers in the Region received 213,000 bales of hay, 620 bags of oats, and 300 bags of buttermilk powder. Total weight exceeded 3,250 tons. The fodder was delivered in 675 trucks and 33 rail waggons. And the Regional staff were inevitably concerned in organizing the receivals and distributions.

The drought stimulated intense interest in water conservation and irrigation. In Maitland district alone, an estimated $250,000 was spent on irrigation plant and new farm-dams.

Extension by Regional staff was largely instrumental in revising farmers' attitudes on hand-feeding and securing a wider acceptance of the use of wheat in cattle-feeding.

The drought forced many farmers to sell out. Seventy-one milk suppliers in the Hunter Valley left the industry. The effect on Dairy Factory Co-operatives is causing concern.

Soil and Water Testing.—Reflecting the urgent search for sources of water for stock and irrigation because of failure of existing supplies, the number of samples tested continued to increase. It reached a total of 1,274 water and soil samples this year in this Region, and 1,166 were water samples. The soil samples came mainly from where moderately saline water had been used for irrigation.

Water-testing now rates a priority as a work prospect in the Region. It has posed a labour problem because of the aggregate-time involved in testing samples.

MID WESTERN REGION

Schools and Field Days.—Schools, field days and conventions in this Region totalled 59, and attendances aggregated just over 3,000. The schools provided subject-matter on livestock nutrition, wool production and marketing, irrigation, lamb production, soils, and botany.

Irrigation Survey.—At the request of the Regional Advisory Committee, an economic study was made to determine basic costs and assess the potential for irrigation on farms in the Lachlan Valley drawing water direct from the river or from underground.

Underground reserves in the Lachlan basin have assumed increased importance. At present the water is being used to irrigate 200 to 400 acres of pasture, lucerne, and crops. Because of increasing costs the water now seems likely to be used more to irrigate cash crops not until now grown extensively in the district—such as grain sorghum, maize, sweet corn, wheat, vegetables and possibly cotton.

Orchard Calendar.—The 4th Edition of the Orchard Spray Calendar was produced, locally published, for fruitgrowers in the Young and Forbes districts. The publication is financed by sale of advertising space. Contents for this comprehensive guide were prepared in the main by the District fruit officer.

NORTH COAST REGION

Regional Supervisor Retired.—After 44 years of service in the Department of Agriculture (the last 13 as Regional Supervisor, North Coast Region), Mr S. R. Ballard retired on 17th December, 1965. Mr Ballard was an officer of the Division of Dairying well-known throughout the industry. He had been North Coast Regional Supervisor of Agriculture since inception of the Region 13 years ago.

Special Agronomist Mr F. Autry-Hall was appointed to succeed Mr Ballard and assumed the duties of Regional Supervisor on 26th January, 1966.

Whole-farm Feed-year Study.—A "rapid-development whole-farm feel year" study was commenced three years ago, to determine the problems of getting research findings applied on commercial farms, and the extent of credit for development of north coast dairy farms. The research programme has been conducted at Wollongbar Agricultural Research Station, and was applied on seven farms in the Richmond-Tweed area.

The project aims to increase annual farm-production of butterfat from 6,400 to 18,000 lb, with corresponding increase in net income of $2,300 per annum.

Although the study has ben extended to commercial dairy farms by the project, the work is still in a research phase.

Bankers' Field Day.—A field day in association with the "rapid-development whole-farm feed-year" project was held in March, 1966, for 100 north coast bank managers and regional officers. A spokesman for the bankers expressed their interest in the project and their appreciation of the potential, national value of increased production in the area.

Crop and Pasture Acreages Increased.—Substantial increases have been made in areas sown to crops of oats, maize, vetches, and subtropical pastures. In one district, the oat-acreage of 12,000 is double that of the previous year.

Fewer Dairy Farms.—The number of dairies in the North Coast Region has progressively declined, from 7,395 in 1955 to about 5,055 at present. Movement from dairy to beef production, and amalgamation of dairy farms into larger commercially-stable units have been common trends in the Region in recent years.

Sixty-eight Farm Demonstrations.—Various combinations of subtropical legumes and grasses were the basis of 68 Farm Demonstrations sown last year. The Demonstrations were financed by funds from the Commonwealth Dairy Industry Extension Grant.

NORTHERN REGION

The Drought.—The drought since early 1965 has had progressively more serious impact on production.

Compared with 1963–64 figures, wheat production in 1964–65 dropped to 3 per cent (322,000 bus), wool production to 70 per cent (and still falling), sheep numbers to 40 per cent (a drop of nearly six million), beef cattle number to 50 per cent (a drop of some 330,000 head), tobacco acreage to about 30 per cent; dairy production was held at a reduced level, mainly by costly irrigation and supplementary feeding; honey production failed entirely, and fruit production was drastically reduced. Pig production showed an increase.

Gift-fodder received amounted to about 10,500 bales of hay, 1,500 bags of sheep-nuts and 650 bags of oats; and over $2,200 worth of nuts was purchased locally, through cash donations. Local committees were formed to help distribute the gift-fodder, and 108 farmers received allocations.

By early June, 1966, a record acreage had been prepared for wheat and most had been sown—with reasonable prospects for germination and establishment.

Regional Boundary Altered.—Followed re-allocation of District extension-officer boundaries, Yallaroi Shire was transferred from Northern to North Western Region.

Television Training School.—Anticipating commencement of a regular commitment to the new commercial channel at Tamworth, an in-service television training school was held for Regional staff with the help of the Division of Information Services and its Closed Circuit Television Unit. A conference has since been held with the station management but there has been no further development.

NORTH WESTERN REGION

The Drought.—The severe conditions have persisted for twenty months to 30th June, 1966, and have made this drought the worst on record in the northwest.

Virtually no wheat was harvested in 1964–65, compared with a normal production of 36 million bushels; sheep numbers fell by at least 20 per cent (2.1 million) and cattle numbers by 60 per cent (250,000); wool production fell by 20 per cent and the number of lambs marked fell by an estimated 50 per cent. About 100,000 acres were sown to grain sorghum but only about 2,500 harvested—for a yield of some 15 bus. per acre.

To these heavy losses must be added the enormous cost of drought-feeding.

Recovery from the drought will be slow. Much will depend on the 1965–66 wheat crop. Given the right conditions an estimated 1.5 million acres will be sown in 1966; 15 per cent more than the 1964 sowing.

About 7,000 bales of hay, 1,500 bags of sheep-nuts and 50 bags of oats were distributed to needy farmers under the "Operation Goodwill" gift-fodder scheme.

Drought-Feeding.—Recommended drought-feeding methods proved very successful. Despite traditional resistance by landholders to feeding whole-wheat to livestock, especially cattle, the measures recommended by Regional extension officers were soon adopted. As a result of this experience, future correct-feeding can be expected—with benefit to the industry.

Irrigation-Provision Increased.—Stimulated partly by drought but mostly by knowledge of the suitability and value of water for irrigation from underground sources, irrigated areas have increased substantially. In the Breeza-Quirindi area alone, flood-irrigation has risen to 10,000 acres in two years.

An irrigation field day at Breeza attracted no less than 600 landholders. Maize, cotton and other row-crops will be the main lines of irrigation-production.

Cotton Increased.—From 80 acres in 1961, cotton has expanded rapidly to 29,000 acres in 1965–66, mostly in the Wee Waa area. This crop was irrigated from the Keepit Dam. But the Dam is now holding only 3.5 per cent of capacity. Thus in the absence of adequate rain to restore the Dam's reserve, the area sown this year is likely to be greatly restricted.

New Agronomist-District.—A new District was created, for an additional agronomist with headquarters at Narrabri. The District embraces the Shires of Namoi and Walgett, formerly supervised by the Moree District agronomist.

SOUTH COAST AND TABLELANDS REGION

The Drought.—Drought-effects on the Region were variable. Some areas fared far worse than others. To December, 1965, assessed stock-losses and reductions by sales amounted to 41,200 beef cattle and 20,800 dairy cattle. Few sheep died through drought and numbers were not appreciably reduced. But over 50,000 mortalities occurred from bushfires and through a cold-snap during shearing.

Some 18,000 bales of grass hay donated by the Snowy Mountains Authority were distributed mainly to drought-stricken dairy farmers on the far south coast. Also, about 350 tons of "Operation Goodwill" fodder was distributed to tableland graziers.

Research-Extension Groups.—The Yass Valley Project continued as a major feature of extension activity. With lengthening of the period of appointment of the Yass Project Officer for a further twelve months, a start was made on the programme for the fourth farm involved in the "Operation Tintacks" project. The Yass Valley Organization continued to play a major role.

An important new development, towards stepping-up the project's extension output has been the initiation of "invitation" field days. Visits by small groups of specially-invited graziers, organized mainly by local branches of farmer organizations, have enabled local people to become better informed on the nature and objectives of the various farm-programmes. The people concerned had tended to shun the bigger public field days on the project farms. These field days tended to be supported more by landholders from further afield.

Two other newly-established research-extension type organizations operating in the Region are the "Far South Coast Research and Extension Organization", based on Bega, and the "South Coast Agricultural Research and Extension Organization", based on Nowra. Regional officers have been closely associated with establishment and operation of these bodies.

The three groups recognize the importance of whole-farm management-education and the involvement of a lot of economic research and planning—again pointing to the need for an Economics Research Officer on the Regional staff.

Regional Development Committee.—The Regional staff continued to take an active part in the three Development Committees operating in the Region. The Illawarra Regional Development Committee published a report recently on "Economic Activity in the Illawarra", and the Southern Tablelands Committee issued a supplement to the 1955 "Report on the Region".

The Southern Tablelands Development Committee staged a successful Industrial Seminar in Sydney under the chairmanships of the Regional Supervisor of Agriculture, appointed chairman of the committee earlier in this year. The seminar aimed to attract Sydney industrialists to extend their activities to country towns. It was attended by some 200 industrialists, also Cabinet ministers and parliamentarians, and representatives of Development Committees from other Regions.

Seed Certification.—The drought seriously reduced revenue from certified pasture-seed production and, to a lesser extent, certified potato-seed. But yields from other certified-seed crops were maintained at normal. Of 3,000 acres of *Phalaris tuberosa* submitted for certification, over 2,000 were withdrawn. Some 800 acres of Kangaroo Valley Ryegrass yielded 7,000 bushels of clean seed.

The "Approved Seed" scheme for potatoes was commenced; 186 acres were submitted for inspection.

SOUTH WESTERN REGION

Regional Supervisor Change.—Mr G. A. Crawford, Regional Supervisor since inception of the Region, transferred to a senior position at Head Office in August, 1965. He was replaced by Mr E. Tindale, formerly Manager of Glen Innes Agricultural Research Station.

Record Rice Production.—The rice harvest was a record; from a record 64,200 acres. The yield was 179,000 tons of paddy, an average of about 2.8 tons per acre.

A Rice Soil-Testing Service to assess the need for nitrogenous fertilizer was initiated. It met with a good response; 410 test-applications from rice growers. The service was at the instigation of the Irrigation Research and Extension Council (I.R.E.C.), with support from Australian Fertilizers Ltd and the Department's Research team at Yanco Agricultural Research Station.

Cotton.—Of 2,500 acres shown to cotton 500 were affected accidentally by hormone spray. Some crops will yield in excess of 2 bales per acre. Others will not exceed 1½ bales.

Research Extension Committees.—The M.I.A. Irrigation Research Extension Committee (I.R.E.C.) continued to stimulate research and extension, particularly for the horticultural, vegetable, and rice industries. Through its many sub-committees, heavy demand is placed on the regional staff. Requests from I.R.E.C. during the year included production of several publications—*M.I.A. Horticultural Spraying Guide* (revision), *Chemical Weed Control in Channels, Pastures and Crops*, *M.I.A. Vegetable Growing Guide* (revision), and *Cotton Growing*. Preparation of two other publications was commenced—*Ricegrowing in N.S.W.* and *Woodlots*.

The Murray Research Extension Committee, formed in 1964, produced a number of useful extension articles. These will be incorporated in the *Farmers' Newsletter* published by the I.R.E.C.

SOUTHERN REGION

Staff Training Schemes.—In the system of regional training for extension staff prior to District appointment, five officers completed a course of training in this Region and were appointed to positions in other Regions. Another officer has commenced training in the Region. Also two University trainees had short periods of training this year in Southern Region.

Opportune Use of Television.—Television's value for effectively conveying emergency information to the whole community was well demonstrated on an occasion this year. Because of the widespread drought in other parts of the State, oat crops in this relatively favoured Region had taken on abnormally high potential-value. But when the crops were nearing maturity, a sudden crisis arose. There were widespread reports of severe caterpillar damage. A prompt survey showed three different types of caterpillars causing rapid damage—as high as 30 per cent destruction in some crops. Lucerne and wheat crops also were being attacked.

With help from Wagga Agricultural College, and the Entomology Branch, Regional officers quickly prepared a television programme. In co-operation with the commercial television station at Wagga a five-minute segment of the "news" programme was devoted to identification and control measures.

This, coupled with use of other mass media, alerted farmers to the danger. Within 24 hours, all local stocks of the main type of insecticide recommended were exhausted. Again television was used, to advise alternative treatment. Within a week, aircraft had effectively sprayed oat and other crops throughout the district.

The emergency-campaign saved potentially high-producing, valuable crops from severe damage.

District Boundaries Altered.—Minor changes were made to District boundaries. The changes resulted from the appointment of a District sheep and wool officer to Albury, a redistribution of duties of the Young District fruit officer and of fruit inspectors in Southern and an adjoining Region.

Post-graduate Extension Course Students' Tour.—The group of nine students in the new, post-graduate Diploma in Extension Course at the University of Melbourne visited the Region for a week—under the leadership of Professor D. B. Williams. The party discussed regional administration and extension with the Regional Supervisor and staff, and also visited the Wagga Agricultural College, the Agricultural Research Institute, private rural-advisers, accountants, and the Soil Conservation Service.

Women's Extension Service.—Rural women maintained in this Region a strong demand for schools on a wide range of topics. The number of schools held was limited only by the resources of the Department's Women's Service. It proved possible to hold five schools.

Pasture Seed Production.—The seasonal conditions led to a big drop in subterranean clover seed production; 800 tons produced, compared to 2,266 in the previous year.

For the first time, Cocksfoot was brought within the pasture seed-certification scheme. Brignoles and Currie strains were certified. Forty-five growers submitted an aggregate of over 1,000 acres for certification.

WESTERN REGION

The Drought.—From a population of 12,775,000 sheep at start of 1965, the total has within eighteen months, been reduced by about 2,000,000. Western Region is also one of the main wheat-producing areas of the State and there were many crop failures in 1965. It is doubted that the wheat acreage sown for grain averaged a yield of more than a bushel per acre.

Prospects for the immediate future were not bright at 30th June, 1966. Good rains, before the end of August, would be essential. Feed was scarce and conditions are not bright for satisfactory 1966 spring-lambing. One of the worst features of the drought was that at 30th June, 1966, Burrendong Dam, on the Macquarie River, was only 0.6 per cent full—with poor prospects of replenishment for use next summer. This would mean curtailment in irrigation of crops and pastures in vast areas of the Western Region.

Overseas Study-Visit by Regional Supervisor.—In late June, 1966, Regional Supervisor Mr B. D. Ament proceeded overseas to attend the International Training Course on Rural Extension at Wageningen, The Netherlands, from 4th to 29th July, 1966, and subsequently to study advisory services elsewhere—in Europe, the U.K., U.S.A., and Canada. He is due back in Australia late in October, 1966.

HAWKESBURY AGRICULTURAL COLLEGE

New Deputy Principal

Mr W. J. C. Hudson, formerly Supervisor of North Coast Dairy Industry Research, was appointed Deputy Principal in succession to Mr B. F. Atkins when the latter was appointed Principal of Wagga Agricultural College.

The Diploma Courses—General

THE AGRICULTURAL COLLEGES ADVISORY COMMITTEE

The Committee was reappointed for a further three years. Major policy matters currently under attention comprise: entry standards and objectives of courses; establishment of a diploma course in poultry husbandry; a post-diplomate course in agricultural extension and farm management; introduction of a third year in the dairy technology course; and the need for more Agricultural Colleges.

HIGH PROPORTION OF PUBLIC SERVICE TRAINEES

At present there are forty (one student in six) Public Service Board trainees for the Department of Agriculture and Department of Conservation Soil Conservation Service in the student total; a record in absolute number and in percentage of student total.

HIGH PROPORTION OF ASSISTED STUDENTS

Of 237 students in residence, 136 hold bursaries, scholarships, traineeships, or other form of sponsorship, and as yet the awards of Commonwealth Technical Scholarships are not finalized. The assisted students comprise more than 57 per cent of the student total; compared with 51 per cent in the previous year. It is encouraging that so many opportunities are being offered. Amongst the sponsored students there are certainly some who might not otherwise have been able to receive College education.

AVERAGE AGE OF ENTRY IS HIGHER

The average entry age of First Year students this year was 18 years 1 month. This, too, was a record. It exceeded by about six months the average of the last five years. It, of course, reflects the higher entry standards, and betokens a greater element of maturity and responsibility. A further by-product of higher entry standards and higher average entry age is the nearer to uniform academic background which will assist the teaching.

The Diploma in Agriculture Course

ENTRY PREFERENCE TO LEAVING CERTIFICATE HOLDERS

In line with the new entrance standards based on academic merit, preference was given this year to Leaving Certificate holders. All of the seventy-five entrants in 1st Year Agriculture had that certificate. Also, six such applicants were admitted direct into 2nd Year.

CHANGES IN THE AGRICULTURE CURRICULUM

Significant changes have been made, especially in 1st Year Agriculture, and more changes are contemplated.

The course now contains more of basic science and provides a more orderly progression from basic to applied disciplines than ever before. The overall goal is to increase the challenge to student-thought and to increase the soundness of their ultimate ability to relate principles to the solution of practical problems.

EX-STUDENTS DOING WELL AT UNIVERSITIES

A study of Rural Faculty University results of Agricultural College ex-students of recent years who are now full-time undergraduates, reveals that most are doing well and some doing exceptionally well. Also, the number of College diplomates who are undertaking part-time University courses towards degrees has greatly increased in the last couple of years.

It is an interesting sidelight that although the number of earlier diplomates who also took University degrees is only a small fraction of the total of University graduates in Agriculture and allied faculties, a survey of their high posts at

Universities and in the administrative and research responsibilities of Government Departments and the CSIRO and kindred bodies, is impressive testimony to the combination of Agricultural College diploma-training and University degree.

The Diploma in Dairy Technology Course

HIGHER ENTRY-QUALIFICATIONS

Of the 18 admitted to 1st Year, 17 students are Leaving Certificate holders. Whilst the minimum entrance qualification is now the Secondary Schools 4th Year Certificate, it is hoped that the entry-applications from more highly qualified students will continue.

PROPOSAL OF A POST-DIPLOMA YEAR

A proposal has been drafted for a post-diploma year for selected Diplomates in Dairy Technology. The drafts evinces heavy bias towards managerial aspects; solid treatment of chemisty and biochemistry; and treatment also of microbiology, engineering, statistics, English expression and report writing, and new products of dairy technology. *Inter alia,* the student would be required to write a thesis including results from his product-development work.

The Diploma in Food Technology

LEAVING CERTIFICATE MINIMUM ENTRY-STANDARD

The minimum entry-standard for this course is the Leaving Certificate, with emphasis on English, Mathematics and Science.

INTAKE TOO FEW THIS YEAR

The optimum intake of 14 students in 1st Year was not realized this year, although there were 58 applications for entry. Some of the applications became ineffective because of acceptances of scholarships to other institutions. In other cases the applicants failed to secure the minimum entry-standard.

HIGH PROPORTION OF ASSISTED STUDENTS

Of the 21 students in the Course, eight have scholarships, e.g., the Commonwealth Technical Scholarship, and 10 others are sponsored by food processing firms. This compares more than favourably with the situation a few years ago when only about a third of the students were receiving financial assistance.

INDUSTRY NEEDS

The Food Technology diploma course provides balanced integration of theoretical and practical food-processing knowledge and skills. The food-processing industry needs more technologists than are available. Facility-improvements and expansion of the intake, say to double the present optimum-intake, would require a greater share of the Commonwealth finance for educational institutions.

Interesting Statistics; All Courses

STUDENT NUMBERS

The statistics of student numbers in the three diploma courses are shown in the following tabulation covering the 11 years from 1956 to 1966:

Course	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Agriculture	198	182	187	187	190	192	187	189	192	181*	180
Dairy Technology	24	34	33	33	32	32	32	31	25	35*	36
Food Technology	12	17	16	17	15	19	25	28	22	23	21
Totals	234	233	236	237	237	243	244	248	239	239	237

(* At the start of 1965 there were 239 students, but three students in Agriculture and one in Dairy Technology withdrew during the year.)

EDUCATIONAL STANDARDS AT ENTRY, 1965 AND 1966

The educational standards of entrants in 1966, compared with 1965, are as follows:

Course	Agriculture Per cent.		Dairy Technology Per cent.		Food Technology Per cent.	
	1965	1966	1965	1966	1965	1966
Leaving Certificate Passed	69	100	67	90	100	100
Leaving Certificate Failed	13	..	..	..	..	..
4th Year Secondary School	16	..	9	5	..	..
Intermediate Certificate	2	..	24	5	..	..
	100	100	100	100	100	100

DIPLOMAS AND YEAR PASSES AWARDED, 1965 CLASSES

The Diplomas and year Passes awarded in 1965 compared with those of 1961, 1962, 1963, and 1964 are shown in the following tabulation:

	1961	1962	1963	1964	1965
Diploma in Agriculture	57	52	53	47	50
Diploma in Dairy Technology	13	16	13	11	13
Diploma in Food Technology	7	9	13*	11	8
Passed 2nd Year Agriculture	54	54	51	49†	57
Passed 1st Year Agriculture	60	52	57	65†	36
Passed 1st Year Dairy Technology	16	13	12	10	17
Passed 1st Year Food Technology	11	12	11	8	12

* Includes one 1962 student, permitted to attend the 1963 final exam.
† Includes one 1963 student, permitted to attend the 1964 final exam

In 1965, four Class II Honours were awarded in Agriculture, one Class I and one Class II Honours in Dairy Technology, and two Class II Honours in Food Technology.

SOURCES OF STUDENTS; AND ULTIMATE EMPLOYMENT PLACES

Agriculture Students and Diplomates.—Of the 50 Agriculture diplomates from the 1965 class, 20 are employed on farming and grazing properties; 15 entered State Departments and four entered other Government agencies; two went to private firms as technical representatives; five entered agricultural and pastoral companies; and four are in miscellaneous positions.

Of the 180 students currently enrolled for the Diploma in Agriculture, 67 (or 37 per cent) are sons of farmers or graziers.

Dairy Technology and Food Technology Students and Diplomates.—The nation-wide importance of the Dairy and the Food Technology courses continues to be shown by the admissions of students from and by the employment of many of the diplomates in other States.

Admissions to 1st Year of the Dairy Technology course in 1966 included 14 from N.S.W. (including nine factory apprentices); one each from Tasmania, South Australia and Western Australia; and one from Singapore—the latter sponsored by the Australian Dairy Produce Board. Only one of them is not a sponsored student.

In terms of States (and elsewhere) the employment of the 398 diplomates from the Dairy Technology course since 1928 is as follows: in N.S.W., 279; Victoria, 48; South Australia, 19; Tasmania 16; Queensland, 16; Western Australia, 12; A.C.T., 2; and six are outside Australia.

Admissions to the 1st Year of the Food Technology course in 1966 comprised six from N.S.W., one from South Australia and two from Victoria.

In terms of States (and elsewhere) the employment of the 101 diplomates from the Food Technology course up to 1965 (and since 1952) is as follows: in N.S.W., 62; Victoria, 19; South Australia, 3; Tasmania, 4; Queensland, 1; Western Australia, 2; and 10 are outside Australia.

DEVELOPMENT OF LECTURERS AND OTHER STAFF

Lecturers' Conference at the College.—In February, 1966, a Conference of Agricultural College lecturers held at Hawkesbury gave staff from Hawkesbury, Wagga, and Yanco Colleges, also representatives from two interstate Colleges and specialist guest speakers the opportunity to exchange, and discuss views important to agricultural education, teaching methods and College functions.

In-Service Training.—Junior officers attached to the various sections of the College and in the clerical staff were given normal in-service training and in appropriate cases were sent to short-term schools and conferences.

External Studies for University Degrees.—Three of the staff are correspondence students for University of New England degrees—one for the B.A., one for the B.Ed.(Admin.) and one for the B.Ed. Two of the staff have been accepted as candidates for the University of Sydney M.Sc.Agr. degree.

STUDENT COUNSELLING, AND SERVICES

Counselling.—The system of officers acting as counsellors, each to a total of about 15 students, was continued.

Also, although the College does not have the responsibility of finding positions for diplomates, an officer kept students informed on career opportunities.

Students' Extra-Curricular Activities.—The Students Representative Council, the Sports Club, the Debating Society, the Camera Club, the Student Christian Movement, and the College branch of the Agricultural Bureau continued, and contributed as usual to the welfare and social life of the College.

A noteworthy extra-curricular activity is the Students' Service Club, formed by them in 1965 and known as the "Hawkesbury Collegians". Students in this club do physical work of a charitable or community-service nature within a short radius from the College. Their first project was completed before the end of July, 1965.

The various teams participated in the Australian Colleges Intercollegiate Contests in rifle shooting and tennis, held this time at Longerenong Agricultural College, Victoria, in August, 1965.

Short-course Schools, and Conferences

The short schools and conferences held at the College this year comprised: the Agricultural Engineering Society School, Dairy Factory Apprentices School No. 1, Junior Farmer School—Poultry, Junior Farmer School—Pasture Improvement, Pig Raisers' School, Dairy Farmers' School, Dairy Factory Apprentices School No. 2, Food Factory Foreman's School, Child Welfare Department School, Summer School in Agriculture, Department of Agriculture Extension Service/Methods School, Dairy Factory Operatives' School, Herd Recorders' School, and the Research Station Managers' Conference, Agricultural Bureau Congress, Division of Horticulture Officers' Conference, Annual Poultry Field Day, Agricultural Colleges Lecturers' Conference, Department of Agriculture Weeds Conference.

Sectional Operations at Hawkesbury

FARM SECTION

The Seasons.—For the twelve months to 30th June, 1966, 2,628 points of rain were recorded. Late winter and early autumn of 1965 were moderately dry. Irrigation was necessary. The spring rains, September/October/November ensured cereal production crops, and seed setting by winter pasture species. The summer, December/January/February, was mostly dry and unfavourable to crop production. Suitable rains in early March allowed sod-seeding of oats and establishment of early sown cereal areas. A moderately dry autumn and mild early winter has been experienced in 1966.

Cereals.—330 acres on the Farm section and 120 acres for student instruction were seeded to cereals in the 1965–66 season. Heavy infestation by army cutworms developed in crop on light sandy soils in the Clarendon/Londonderry areas and destroyed some 200 tons of green fodder. The weed Paterson's Curse has built up heavily in the Clarendon paddocks. It came in cereal seed transferred from other farms.

Some 340 ton of crop was cut for silage, and 100 ton of baled hay and 100 ton of sheaf hay were stored as fodder reserve.

Except for 11 acres of Jap Millet and eight acres of Sudax for grazing under irrigation in the dairy paddocks, summer fodder-crop production was confined to the River Farm. From the 16 acres of maize and 20 acres of sorghum cut for silage, 400 ton was stored in the Dairy Section silos and two 60-ton vacuum silage stacks at the Beef Cattle Section.

Lucerne.—Lucerne production has been reasonably successful. From 19 acres established in Clarendon No. 13 paddock 110 ton was harvested—from six cuts. From a further 16 acres, seeded at the River Farm in autumn 1965, three light cuts were made. Although they yielded only 30 cwt per acre this stand appears to be better than previous sowings and could build up to a fairly productive area. Eight acres in the Richmond area were also established this autumn to lucerne, in anticipation of more water for irrigation this summer.

Fodder Reserve.—A year ago 150 ton of sheaf hay was on hand. Another 100 ton was added last harvest. At 30th June, 1966, there is 130 ton on hand, 120 ton having been chaffed for horse feed. Two hundred ton of baled cereal hay is stored in Farm hay sheds.

A total of 150 ton of lucerne hay was produced. The reserve is now 80 ton, 70 ton having been used at the Dairy, Beef Cattle, and Sheep Sections.

A total of 135 ton of pasture hay of mixed quality was produced for the Dairy Section. With 35 ton carried over from the previous year, and 115 ton used, 50 ton is in reserve.

Throughout the year, 742 ton of crop was cut for silage. With a drought reserve of 500 ton in underground pits, the College at 30th June, 1966, has 920 ton of silage in reserve.

In grain fodder, there was at 1st July, 1965, a carryover of 25 ton of wheat, from other Departmental properties. The rest of the wheat fed at the Dairy, Poultry, Piggery, and Sheep Sections was purchased from the Wheat Board. An amount of 4,719 bushels of purchased oaten grain, including 1,200 bushels on hand at 1st July, 1965, was fed to stock. At present 200 bushels of oaten grain are in store.

Water Storages.—Storage capacity in the Turkey Nest Dam was increased from 10 to 18 million gallons, by contract work. Repair of the Hillside Dam has started, using College equipment. If this is successful there will be adequate water storage, 28 million gallons capacity, for irrigation of the proposed 40 acres of winter pasture and 20 acres of summer pasture for the Dairy Section.

Sewage Effluent Water.—At present 30,000 gallons of this water per day is being used for irrigation of 19 Clarendon acres of lucerne. To continue irrigation of this area there is a need for further storage. Extension of irrigation for a winter pasture area is also required.

A decision by the Water Sewerage and Drainage Board, on use of effluent water by the Golf Club and the College, will allow irrigation plans to be formulated in light of available water.

AGRONOMY SECTION

Trials Decentralized: Inter- and Intra-State.—A large number of vegetable, plant nutrition, and weed control trials were established by the College research agronomists in various parts of New South Wales and other States.

Co-operative Research with External Authorities.—Research was undertaken with the Universities of New South Wales and Sydney, the CSIRO Divisions of Food Preservation and Plant Industry, the Australian Atomic Energy Commission, as well as with Divisions of the Department of Agriculture in this and other States, and New Zealand; and with commercial firms and private individuals. The co-operative weeds research programme with Geigy Agricultural Chemicals continued.

Extension and Lecturing Activities.—Information and advice were conveyed by correspondence, telephone, and personal contact, arising from the research agronomy. And the College agronomists addressed field days and farmers' schools at the College and in the adjacent and other districts.

Lectures and demonstrations were delivered also to College and University students, relative to the various fields of research being undertaken.

Agronomy Research Reports.—Detailed reports were submitted to the Chief, Division of Plant Industry for collation in that Division's report, in respect to: Vegetable breeding and introductions; pasture research; research into other crops; weeds research; and the plant nutrition programme.

ORCHARD SECTION

Staff.—Death of the Officer-in-Charge, Mr J. D. Bryden, and resignation of another fruit officer at about the same time left the Section without a resident for several months until

Mr J. Holbeche took up as Officer-in-Charge in January, 1966. In the interim the orchard was supervised and the lectures were given by District fruit officer Mr J. Stone on a part-time basis.

Demonstration Facilities.—All demonstration plantings were maintained in good condition with the aid of irrigation and constant summer attention to weed control. The facilities for student demonstrations and general practical training were good.

Information on orcharding matters was given to many visitors to the College.

Research.—Citrus: The Washington Navel Rootstock trial established in Yarramundi Orchard severely declined in the two successive years of low rainfall. Its termination has been recommended. A citrus variety collection has been maintained, and recording of growth and fruiting characteristics has commenced. *Persimmons*: A variety collection of these fruits has been maintained. Tree rejuvenation work in the planting, made in 1945, has started. Trees of selected varieties have been propagated and a trial planting of these is to be made in the 1966 winter. Blossoming and fruitfulness studies are continuing.

Orchard Development and Reconstruction.—Reconstruction of the orchard section over recent years has provided excellent facilities for student instruction.

Further plum, peach, and citrus plantings were made this year, to further the plan for trees of all ages, in the different kinds of fruits, to be available for demonstrational purposes.

Old nursery areas have been renovated. A new site has been partly prepared for next season's nursery plantings. The nurseries are proving of great value for instruction, besides providing trees for plantings.

A planting of strawberries has been made to demonstrate latest methods with this crop.

HORSES

At 30th June, 1965, there were 66 head of horses on the College, including three on agistment. During the year 13 mares were received for service.

In the Arab stud: six foals were born from 18 brood mares; four foals died; two foals were reared; one Arab colt and two Arab mares were sold.

The draught brood mares, two hacks and one crossbred gelding were transferred and five crossbreds and draughts were sold.

Thus, at 30th June, 1966, there were 54 head of stock on the College, including two on agistment.

SHEEP SECTION

Hand-feeding Needed.—Late in 1965 and early in 1966 heavy hand-feeding, on wheat grain, was necessary. There is still some hand-feeding but grazing crops have relieved the feed situation.

Field Trials and Research.—These activities had to be reduced because of extra commitments to demonstrations, arising from curriculum changes.

The co-operative project with a research agronomist, on pasture evaluation for prime lamb production, was successfully completed. Further work has been planned, to use merino wethers at high stocking rates for wool production.

Other co-operative projects in hand include: two with "Ciba" chemical company, testing a new fly-dressing preparation and also a new dipping-preparation; one with Glenfield Veterinary Research Station, testing stability of diazinon-lime sulphur dips; others with the Division of Science Services and Boots Pure Drug Company, testing new jetting-compounds and testing for O.P. resistance; and a pilot trial with Seven Hills Poultry Research Station, testing the value of poultry manure and deep litter as a sheep feed.

A stud-ram preparation and comparison demonstration has been completed, and a new similar project is ready to start when the new animal-house is ready for occupation.

A series of feeding trials to help Riverstone Meat Company to solve a specific feeding problem is about to start.

Demonstration Facilities Improved.—Facilities are now excellent for demonstrating manual skills and techniques in sheep management and husbandry for maximum production per animal. The facilities include a new demonstration room, improved areas of irrigated pasture, additional flocks and supplies.

Much remains to be provided to enable satisfactory instruction in grazing management and pasture utilization, through the production per acre type of demonstration unit.

Flock Statistics.—There were 1,726 sheep at 30th June, 1966; comprising 276 commercial Flock ewes, 194 Merino Flock ewes, 233 Merino Flock hoggets (rams and ewes), 923 ration and general demonstration sheep, and 100 demonstration rams.

Shearing 1965–66.—The shearing yielded 39 bales (12,410 lb) of greasy wool. Net proceeds $5,040.60.

Natural Increase.—In the Research Flock, from 160 ewes mated the "lambs marked" percentage was 130; in the Commercial Flock the "lambs marked" percentage was 117 from 220 ewes mated; in the Merino Flock it was 84.8 per cent from 286 ewes mated. For the total of 666 ewes mated, in all Flocks, 110.3 per cent "lambs marked" was the average.

DAIRY CATTLE SECTION

Competitive Exhibits, at Shows.—Fourteen Friesians were exhibited at the Royal Easter Show. Seven First, seven Second, six Third, and two Fourth places were won; also the Reserve Junior Champion Heifer award with "Hawkesbury Proud Beverley" in the 3-12 months heifer class; and the College was Most Successful Exhibitor for the sixth consecutive year. Stud sales at the Show realized $2,420 for three heifers.

Fourteen Friesians were exhibited also at the Hawkesbury District Show. This team met keen competition from local breeders. Four First, nine Second, and three Third places were gained; "Hawkesbury Countess Voyageur" was Junior Champion bull.

Friesian Stud Numbers.—At 30th June, 1966, the stud totalled 130 (30 less than a year earlier), and comprised two adult bulls, seven loan bulls, 52 cows in milk, six cows dry, 20 heifers, and 43 calves less than 12 months of age. There were three fewer adult bulls, 24 fewer heifers and five fewer calves than a year ago.

Births during the year totalled 62, comprising 40 males and 22 females.

Stud Sales.—College Friesians were again very much in demand. There is still a long waiting list. Sixty-three Friesians were sold for a price-average of $163 and total of $10,250.

Breeding Programme.—The recently revised breeding-programme is now being implemented. Artificial insemination will again be important in the programme; with wide use of "Sniders F. H. King" and, to a lesser extent, "Frasea Lord Jewel", "Trailynd Royal Beau" and "Hawkesbury Countess Voyageur".

"Hawkesbury Pride King" and, to a lesser extent, "Hawkesbury Countess Voyageur 2nd" are in natural service. "Corhan Ross Castillian" is on loan to the University of Sydney for semen-collection investigations.

Seventeen sires have one or more female progeny in the herd.

Herd Production Averages.—The latest released herd-recording figures are for the year ended 30th June, 1965. These reveal the following averages for the College herd for that period:

Age	No. of Cows	Total Milk	Total Butterfat	Average Test
				Per cent
2 years	7	9,958	366	3·7
3 years	8	10,335	368	3·6
4 to 9 years	38	13,189	497	3·8
Over 9 years	2	12,848	417	3·2
Herd Average	55	12,350	459	3·7

Trials and Experiments.—Those completed during the year included: Growth and development weighing-trials; Calf-feeding trials; and a Fly-repellent trial; and the current trials are concerned with Mastitis incidence; Solids-not-fat; and Identical twin heifers.

Twin and Demonstration Herd.—The College Demonstration herd now comprises two Guernsey cows—from Yanco Agricultural Research Station, two Jerseys cows—from Wagga Agricultural College, two Ayrshire cows—from F. A. McIntosh, Berry, and three A.I.S. cows—portion of the twin trial.

There are four sets of identical twins in the herd.

BEEF CATTLE SECTION

This was a year of consolidation for the Beef Cattle Section, in that a number of essential facility- and structural-improvements were made, and herd improvement activities were emphasized.

Stock Numbers.—The beef cattle total has varied from 126 to the current 206 head.

Poll Hereford Stud.—Herd improvement activities, with accent on breeding-performance and production-selection of replacement heifers and potential sires, provided valuable student instruction.

This stud herd now comprises: 45 females, including 15 unselected weaners and six adult females listed for culling; 11 males, including two on loan to the Artificial Stock-breeding Centre, Berry; two sires in use at the College; and seven calves at foot—unselected or undergoing production-selection in student demonstrations.

Four new stud heifers in calf have been bought from "Wirrina" Stud, Wagga Wagga. The sire "Kildrummie Toledo" bought last year from Mr D. Carnegie, Holbrook, has developed well. His first calf-drop is due in July, 1966.

One surplus, good-quality bull was sold, from a long-term production-selection demonstration for students.

Commercial Herd.—This is to be gradually increased to provide for the comprehensive needs of the student-instruction programme. The herd has been invaluable in the past year, in providing for long-term demonstrations in management, production, and pasture utilization, as well as husbandry method-demonstrations. The commercial-herd improvement practices have also yielded surplus animals for ration purposes.

The Ration Herd.—Due to the prevailing drought, it was difficult to provide sufficient ration beef for the College. For six months, slaughterings had to be cut by at least 50 per cent. More recently 91 head of various classes of cattle have been received on transfer from other drought-affected Stations, and slaughterings are back to normal. Of 76 head of beef killed for rations during the year, 20 were from College herds.

The Demonstration Herd.—Additional, representative breed animals for this herd are still being sought. There are now Herefords, Shorthorns, Angus, and Red Polls in the herd. Donation of Devons already promised has been delayed by the drought. Murray Greys and Brahmans are likely additions soon. And efforts are being made to acquire Brahman semen, for student demonstrations in Brahman x British breed hybrid-work.

Demonstrations.—The several long-term demonstrations either completed or still in progress, comprise: breeding-herd management, with particular emphasis on herd improvement and fertility, including pregnancy-diagnosis, at both stud and commercial levels; steer production demonstration—including comparison of the economics of feed-lot finishing and pasture-feeding; production-selection of replacement heifers, stud and commercial; selection of young bulls on production and grade, and practical assessment of sire influence; intensive management of weaners, rotationally grazed on irrigated pasture sod-seeded with grazing oats; breed-influence on cross-breeding practices, comparing various crossbreds under identical conditions; fattening of backward store-steers to slaughter condition; and creep-feeding of beef calves, the economics and benefits.

POULTRY SECTION

Breeding.—Normal breeding operations were carried out, with the poultry and turkey flocks. Only four stud birds were sold.

Pure Breeds Tests.—The 4th Pure Breeds Test ended in December, 1965, 462 days after hatching. A report has been published.

For the 5th Pure Breeds Test, eggs were set in July, 1965. There were 24 entries, seven fewer than in the previous test. Only 20 of them were still in the test when the birds were housed at the 141st day. The four groups eliminated had failed to rear the now necessary minimum of eight birds. The Test will extend to 462 days.

Random Sample Laying Tests.—The 13th Random Sample Laying Test ended in December, 1965. The report has been published.

The 14th Random Sample Laying Test started in August, 1965, with 23 entries; two fewer than in the 13th Test. The 14th will extend for 462 days from the date of hatching of each sample. Some records seem likely to be broken during this Test.

Random Sample Broiler Test.—The 6th Random Sample Broiler Test ended in July, 1965. The report has been published.

The 7th Random Sample Broiler Test started in May, 1966, under revised rules. There are now a *Commercial Test* open to the Breeding Groups, to test commercial strains of chickens already being marketed, and a *Development Test* providing opportunity for breeders to evaluate special strains of chickens they are developing. The tests will end on 14th July, 1966—nine weeks from hatching.

Annual Poultry Farmers' Field Day.—This annual event was held on 25th September, 1965. It drew a large crowd of poultry farmers, sales representatives, and equipment manufacturers. A feature of the Day was the Hawkesbury New Equipment Award. This innovation created a lot of interest.

Instructional Value.—The Poultry Section continued to be a valued demonstration resource for students and the public interested in poultry industry.

PIGGERY SECTION

Present Breeding Stock.—This comprises one Tamworth boar and five sows, two Berkshire boars and four sows, two Large White boars and 11 sows, two Landrace boars and four sows, and three cross-bred sows.

Livestock, General.—Sixty-two litters were farrowed. New blood was introduced into the Large White and Berkshire herds, by buying a new boar in each of these breeds. Aged sows were heavily culled and the herds are now largely first-litter stock.

Sales; Stud and Market.—Demand for stud pigs is increasing. The College was unable to satisfy the requests received. Fifty-two stud pigs were sold, for $3,069; and 53 pigs were marketed, for $2,507.

Schools and Demonstrations.—The very successful school for farmers in the pig industry drew 40 into residence. They came from many areas of the State and from enterprises ranging from 500 brood-sow strength to beginners with two to five sows. A day was conducted also for Sydney Technical College students in Agriculture.

Student Demonstrations.—These comprised: continuous *nutrition demonstrations* concerned with varied protein supplements as affecting weight-gains and feed-utilization efficiency, mineral and vitamin supplementations, copper as a growth-stimulant, energy and protein-balance effects, and feeding-methods in relation to carcass-quality; projects in *partial-controlled environments*, using the Harper Adams type-shed to measure the effects of temperature, air velocity and humidity on performances; and *breeding* projects concerned with the importance of strains within the breeds, and comparisons of distinct strains for variations in economic values.

Performances of hybrids were illustrated. And by multiple-mating some aspects of mode of inheritance were demonstrated.

The early-weaning practice, because of its increasing use and its effect in pig industry economy was highlighted.

APIARY SECTION

The Seasons.—The spring was good enough for establishment of near to 200 baby nucleus-colonies for queen-rearing. Subsequent drought conditions made necessary a constant feeding of these small colonies with sugar syrup, to continue the queen-raising programme. The baby nuclei are re-united to parent colonies during the autumn at the close of the bee breeding season.

Movement of Hives to Bathurst.—To get honey, 40 productive colonies were moved to Bathurst. Bud prospects there had indicated a probable reasonable flow from Yellow Box and Red Gum. The dry weather reduced the yield. Only 900 lb. of honey was obtained. This provided for an extracting-demonstration at the Summer School in Apiculture.

College-bred Queen Bees in Demand.—The demand continued to increase. A record total of 510 queens was supplied, mainly to N.S.W. but some to Victorian and Queensland beekeepers. The main problem has been to overwinter successfully the parent lines, for unrestricted breeding in the following season.

Summer School and Field Day.—The annual Summer School in Apiculture was held for six days in January. The Amateur Beekeepers Association Field Day was held at the College on 26th February.

Statistics.—At 30th June, 1966, there were 55 productive hives and 30 nucleus hives; compared with 50 and 20 a year earlier.

School of Dairy Technology—Hawkesbury College

GENERAL

Limited Milk Supplies.—The continued dry conditions led to low intakes of surplus milk for student training. Training continued by expedient resort to: saving of all milk from the College bails; acquisition of small quantities (about 300 gals/week) of whole milk from Manning River Co-operative Dairy Society, Hawkesbury Dairy and Ice Society and United Dairies Pty Ltd, suiting manufacture of small vats of cheddar and fancy cheeses; and acquisition of surplus whole milk from Nepean Dairy Society and, when this was unavailable, some skim milk from that Society.

With the contraction of milk supplies in the area, considerable effort is being invested towards assuring regular supplies for the future of the Dairy Technology training. The details of steps being taken are on file.

Dairy Industry Apprenticeship Scheme.—Difficulties in regard to practical instruction of apprentices have been discussed at sub-committee meetings of the Dairy Industry Apprenticeship (N.S.W.) Scheme.

Dairy Factory Operatives' Training.—A short laboratory-course for dairy factory operatives was conducted.

Facility Improvements.—The improvements in buildings and equipment have been considerable and others have been programmed, including alterations to the lecture room and laboratory—for accommodation of more students and a proposed Third Year in the Dairy Technology diploma course.

FACTORY PRODUCTION STATISTICS

Statistics of production, with comparisons for the previous five years, are shown in the following tabulation:

	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
Butter (lb)	203475	263268	306799	218637	213303	83107
Cheese (lb)—						
Cheddar	150424	121244	146657	141196	82822	86496
Fancy	1219	870	1391	959	874	1394
Milk ex H. D. & I. Surplus (lb)	1617826	1007252	1675147	218641	..	18770
Milk ex Nepean Dairy Society Surplus	842916	1013817	870442	1891965	1210984	1313159
Milk ex H. D. & I. Reject	146100	14878	169864	107420	6839	..
Milk ex United Dairies Surplus	..	..	..	..	..	98162
Milk Pasteurized	2842497	2918811	3052919	3269533	3633472	3085262
Milk from other sources	312844	135925	246175	214806	582242	206103
Ice Cream (gal)	2335	2202	2066	2374	2106	1723
Dried Milk (lb)	70500	57524	102036	36793	35357	32480
Condensed Milk (gal)	..	71	117	..	48	74
Flavoured Milk (½ pint cartons)	113280	86960	3578	2531	59152	29408
Cream Mix (gal)	..	169	175	358	290	8

DAIRY RESEARCH

Death of Principal Research Officer.—The untimely death of Dr Solomon Bakalor is recorded with deep regret.

Dr Bakalor had built up a team, working on three important projects. Mrs G. Farrell has helped considerably in keeping the projects active. Applicants for Dr Bakalor's positions have been interviewed.

Loss of Other Research Officers.—There are two vacancies for research officers, through an officer transferring to the Ruakura Research Centre in New Zealand and another's acceptance of a position in the cheese manufacture industry.

University Students in Laboratory Studies.—University students were again employed during their vacations, and made useful contributions to laboratory investigations and manufacture research.

Rapid Methods for Determining the Composition of Milk.—Work on methods for determining the protein content of milk was completed and has been published.

A useful, automatic formol-titration technique was developed. Estimation of protein from its ultra-fluorescence in the ultra-violet region or from dye-binding proved less successful.

Work continued on a rapid high temperature method for determination of total solids, using a thermostatically controlled hot plate.

Two new projects were commenced with the support of the Australian Dairy Produce Board.

Influence of Seasonal Variations, in Compositional Quality of Skim Milk, on Physical and Chemical Qualities of Spray-Dried Skim Milk Powder.—Since November, 1965, test batches of skim-milk powder have been manufactured regularly at the Factory from milk produced in a selected area.

The milk is pre-heated at 175°F for 10 minutes, as desired for powder to be used for recombining into sweetened condensed milk. Samples of the raw skim milk used for processing are heated in the laboratory at 175°F for 10 minutes and at 190°F for 30 minutes. These samples are compared with the plant-heated milks. A detailed protein-analysis to determine the breakdown of proteins due to heat treatment is done.

Results so far show a marked reduction in the non-casein protein and total albumin nitrogen fractions with increasing severity of heat treatment.

Further examination of the bulk skim-milk includes determination of total solids, lactose, chloride, calcium, total and inorganic phosphorus. The powder is tested for moisture, fat, protein, lactose, chloride, calcium and phosphorus as well as for heat stability, whey protein nitrogen index, solubility, pH, acidity and viscosity on recombining.

The project will continue for at least another year, to demonstrate seasonal trends.

Problems Associated with the Manufacturing and Keeping Qualities of Processed Cheese.—A bibliography of significant processed-cheese work published over the past 26 years has been compiled.

The Kustner pilot-plant at the College Factory was studied and methods for manufacturing and packing the cheese were established.

A series of trials using these methods were conducted to compare a number of emulsifying salts, including the commercial "melting salts" and the basic chemicals from which they are compounded.

The products were compared for flavour, body texture and slicing quality, after cooling, and again after being stored for four weeks at 55°F and 77°F. The moisture, fat content and pH of the raw materials and final products were determined. Marked differences were shown in the cheese processed with various emulsifiers.

Some preliminary trials were done to determine the effect on the processed cheese, of varying age and body of the raw cheese and of the pH of the mix before and after melting.

A rapid high temperature method using a specially designed hot plate has been developed for determining moisture content of the raw cheese and of final products. This test is now being used in the manufacturing trials. It should be suitable for commercial control, as only 5–6 minutes of heating time is required.

Infra-Red Milk Analyser.—The Infra-Red Milk Analyser (I.R.M.A.) was delivered and installed in April, 1966. Functional problems, in the homogenizer and electronics unit, have prevented any more than preliminary work on the calibration of the instrument.

Accelerated Detergent Testing.—Testing of commercial detergents and cleaning systems was commenced in the previous year and has continued. There has been close co-operation with manufacturers. This has resulted in approval of several products which meet the specifications of the triple or 3-step cleaning system.

A comprehensive Departmental pamphlet describing the 3-step cleaning system has been prepared for early issue to all dairy farmers.

The system forms the basis of a *Code of Practice*, for use of dairy detergents, being prepared for the Standards Association of Australia. A *Standard of Performance for Detergents* is to be drafted. This formidable task will be aided by the construction of a more refined model of the milking simulator, now nearing completion.

Testing of Sanitizers.—The original project has been discontinued, through resignation of the officer concerned. But a new series of simple field trials has been initiated, to devise a suitable testing method.

Detergent-Sanitizers.—In the hope that earlier problems with foam-cleaning of machines may have been overcome, field trials of a commercial product are being undertaken on seven farms.

Milking Machines and Mastitis.—Difficulties continue in obtaining cows suitable for the experiment and in milking them in the present experimental bail. New bails have been planned to obviate the problems.

Meantime, considerable work has been done towards the improved "California Mastitis Test", to give more rapid assessment of the leucocyte content of milk. Some results of this work were presented to the Australian Dairy Produce Board seminar in Melbourne in April, 1966.

The Microflora of the Milking Machine.—This project has been planned to co-ordinate with one by Dr J. McPhillips of the N.S.W. Milk Board wherein he is studying the Preliminary Incubation Methylene Blue Test for chilled bulk-milk and its effect on the microflora of the milk. At the College the microflora of the machine will be studied, using a rinse technique.

School of Food Technology—Hawkesbury College

EDUCATIONAL

For the greater part, the education facets have been reported earlier under "Diploma Courses".

Seventh School for Factory Foremen.—In conjunction with the N.S.W. Food Technology Association, this school was successfully conducted. Forty-three attended, from five States. Twenty-seven firms from diverse sections of the food processing industry were represented by them.

Needed Expansion of Facilities.—Considerable expansion of facilities and equipment is needed for introduction of a course designed for students likely to enter in 1968 with the minimum qualification a Higher School Certificate.

PROCESSING OPERATIONS

The basic aim of the practical, cannery operations is education—not production. But most of the processed fruit and vegetables used by the College, and miscellaneous foodstuffs such as custard power, jelly crystals and tomato pulp for soup stocks, were provided by the cannery.

WAGGA AGRICULTURAL COLLEGE

New Principal

The Principal, Dr F. C. Butler, was appointed Assistant to the Deputy Director-General and subsequently to the position of Deputy Director-General, Department of Agriculture.

Mr B. F. Atkins, formerly Deputy Principal at Hawkesbury Agricultural College, succeeded Dr Butler as Principal of Wagga Agricultural College. He was appointed in October, 1965.

Other Appointments.—Mr K. J. Symes, formerly a Senior Research Officer at the Agricultural Research Institute, was appointed as Lecturer in Biology at the College; Mr W. C. Pearson as Lecturer in Agricultural Engineering; Mr P. J. Duff as Lecturer in Beef Cattle Husbandry; Mr D. L. Joyes as Liaison Officer. All staff vacancies were filled as at 30th June, 1966.

The Diploma Course

Student Numbers.—The seventeenth academic year started with a total of 133 students. A further student was later permitted to repeat Third Year from the start of the second Term, 1966. The student total was thus the highest since the College was founded, with every available room occupied.

The following comparative total indicates student numbers over the past five years:

	1962	1963	1964	1965	1966
First Year	39	44	54	55	64
Second Year	31	37	32	41	34
Third Year	28	28	33	30	35
Totals	98	109	119	126	133

Of the 55 First Year students at the start of the 1965 academic year, only 33 were admitted to Second Year in 1966. The high failure rate and number of withdrawals thus again caused an imbalance between the years. This presented problems in class sizes and accommodation in the various lecture rooms and laboratories. The higher academic rating of the current First Year group (1966) should markedly reduce the failure rate.

Diploma Examinations 1965.—Of the 32 candidates for the 1965 Third Year Final Examinations, 28 succeeded at the time, one with Second Class Honours, and three more gained the Diploma as a result of deferred examinations. The other candidate elected to repeat Third Year and is now in residence.

The total of Diploma holders since 1951 now stands at 344, including 30 with Honours.

Ex-students.—The total of ex-students is 536 (including two who withdrew in first or second year term, 1966). They are vocationally placed as follows, so far as is known:

1. Following Agriculture—		
(*a*) On farms		237
(*b*) In Government Departments or with quasi-governmental authorities—		
Agriculture	63	
Soil Conservation	16	
Education	4	
A.B.C.	2	
Valuer-General	6	
Others	22	
	—	113
(*c*) With commercial firms		53
		403
2. Undergoing further training		21
3. Left agriculture		32
4. Occupation unknown		74
5. Deceased		6
Total		536

Thus, about 90 per cent of the Old Boys whose occupations are known are applying their training to rural and allied vocations.

Curriculum Trends.—There have been few changes compared with the previous year. One notable modification is the transfer of "Pasture Establishment and Management" from Third Year to the second half of Second Year, to enable lecturers in livestock subjects to deal more effectively with pasture utilization in the Third Year.

Because of the very large First Year group, all Biology and most other demonstrations have had to be delivered to quarter-classes. This has doubled the First Year use of the Biology Laboratory and, coupled with the laboratory needs of the lecturer in Animal Husbandry, has made very urgent the provision of further laboratory facilities.

Staff Developments.—Lectures and demonstrations in Apiculture were provided by a field officer of the Southern Agricultural Region.

Appointment of a lecturer in Farm Engineering helped the College to become still less dependent on Wagga Technical College. Wagga Technical College still provides the instruction in Woolclassing, Welding (oxy-acetylene and electric) and in Surveying-Building Construction.

A lecturer in Beef Cattle and Horses was appointed. Previously, an officer seconded from Division of Animal Industry provided this subject-matter.

Appointment of a Liaison Officer has assisted the co-ordination of curricular and administrative matters in general.

Commonwealth Funds Effect.—In 1964–65 the Hawkesbury and Wagga Agricultural Colleges shared an initial allocation of $126,400 for essential buildings, plant, and equipment. This was from funds made available by the Commonwealth Government in terms of the States Grants (Science Laboratories and Technical Training) Act 1964. By further negotiations, greatly increased grants, totalling $800,000, have become available to Agricultural Colleges in this State for the triennium 1965–66, 1966–67, and 1967–68. Of the allocation, $440,000 will be spent by Wagga Agricultural College. Several buildings have been erected or are in the course of construction because of these funds; and considerable technical equipment, modern machinery, and teaching aids have already been purchased.

New Buildings Completed.—(i) A glasshouse for experiments in plant nutrition, diseases, and pests; and to grow, under controlled conditions, out-of-season crops, plants, pasture plants, and weeds; (ii) a welding workshop with 18 bays fully equipped for both oxy-acetylene and electric welding; (iii) a woolclassing unit with demonstration space for two instructors; (iv) an animal nutrition unit for student projects in sheep bodyweight gains and losses, and in wool production on controlled diets.

Each of those new buildings is contributing significantly to improved levels of instruction, student participation, and interest.

Practical Training.—Woodwork and Metalwork have been deleted from the curriculum. Of greater significance is the increase from 8 to 12 weeks in duration of practical experience (on approved private farms during vacations) as a prerequisite for the award of the Diploma. The College has some 80 progressive landowners as co-operators in this scheme. The number of landowners willing to employ students is increasing. The work is controlled by the College.

The College records indebtedness and gratitude to the many private farmers who are giving during student tours unreserved co-operation in whole-farm studies in management and in general farm operation, and to those who are providing the opportunities for valued practical experience during the vacations.

Students' Extra-curricular Activities.—The College competed in the Australian Agricultural Colleges Sports Contests held at Longerenong in western Victoria. Also, liaison and public contact were maintained through participation in the Riverina Rugby Union and in basketball, cricket, and athletics competitions.

The extra-curricular activities included also religious instruction and Church services at the College; First Aid courses for new students; assistance with local civil authorities in bushfire control.

Student Tours.—Third Year students made the annual 5-day tour of central slopes, southern tablelands, and coastal regions early in September, 1965. The Batlow Tour was not conducted in 1965. Two one-day tours of Coleambally and Murrumbidgee Irrigation Areas were undertaken by Third Year students.

Half-day or one-day visits were made to local and district studs, and to properties for the purposes of farm management surveys and valuation exercises.

Show and Competition Experience.—Senior students gained experience as stock attendants and in judging competitions at the Royal Easter Show, the Wagga Wagga Show, the Wagga Ram Show and Sales, the Albury Sheep Show, and the Merino Ewe Breeders competition.

Short Schools and Conferences.—The 15th Annual Wheat and Sheep Husbandry School for Junior Farmers was held in August, 1965; attended by 19 young farmers.

The 14th Annual Turkey Breeders Conference and School was attended by approximately 50 delegates and as usual was highly successful.

Sectional Operations

FARM SECTION

Seasonal conditions at the College were the worst since the dry year of 1957–58 and grain and hay yields were low accordingly.

Cereal Crops.—The total area sown to cereal crops in 1965 was 441 acres. This comprised 201 of wheat, 183 of oats, and 57 of barley. Grain yields were the lowest since 1959–60; 21.1 bushels/acre for wheat, 18 bushels/acre for oats, and 20 bushels/acre for barley.

Cereal crops shown in 1966 comprised 235 acres wheat, 161 acres oats and 50 acres barley; a total of 446 acres.

Foundation Seed for Cereal Seed Schemes.—Grain production included foundation seed wheat and barley. Of this seed, 178 bushels of wheat and 440 bushels of barley were distributed to registered seed-growers, experiment areas, and Research Stations. Seed of the new loose-smut resistant strain of wheat, Heron, was grown for the Agricultural Research Institute.

The College is the only producer of seed barley within the Department of Agriculture, and seed of ten varieties is produced and distributed.

Fodder.—Hay and silage production was adequate for immediate requirements. There is a carryover of at least 150 tons of silage and small quantities of cereal and pasture hay. Quantities of fodder conserved during 1965–66 were 140 tons silage, 37 tons cereal hay, 150 tons pasture hay, and 71 tons lucerne hay.

Pastures.—Some 1,200 acres are under sown pasture. Sixty acres were sown this year. The area sown to lucerne was reduced to 130 acres when several old stands were ploughed out.

Experiments Areas.—An oat variety trial of sixteen varieties and crossbreds was grown. Fodder and grain yields were recorded.

Land for cropping, grazing, weed control, and soil trials was made available to the Agricultural Research Institute. A new trial was started by the Institute, "Sheep Management—Time of Lambing", utilizing 122 acres of College land.

The CSIRO was also supplied with land and facilities, for pasture species work.

Irrigation Developments.—The spray and flood irrigation sections are now both in use, providing valuable fodder as well as for student instruction. The spray irrigation area produced 71 tons lucerne hay, several hundred tons of green lucerne forage for dairy stock, and limited grazing. The flood section allowed demonstration areas of grain sorghum, safflower, and sunflower. Trial vegetable plots included potatoes, peas, tomatoes, pumpkin, sweet corn, and cucumbers.

HORSE SECTION

Numbers.—At 30th May, 1966, the horse total of 50, eleven fewer than at 30th May, 1965, comprised: seven entires, 25 mares, 12 geldings, and six foals. There were four more entires, three less mares, seven less geldings, and six less foals than a year ago.

Sales.—Two colts and four females were sold, netting $2,560. One colt was offered and taken as a replacement for a previous sale.

Service of Outside Mares.—Six originals and one free return were given, netting $304.

Competitive Exhibits.—Five horses were shown at the 1966 Royal Easter Show. The awards won were Reserve Champion Mare, one First, two Seconds, and two Third placings.

BEEF CATTLE SECTION

Numbers.—At 30th May, 1966, the beef cattle total of 94, seven more than at 30th May, 1965, comprised 13 stud bulls (+ 3 compared with 12 months earlier), 62 stud females (+ 1), seven grade cows (equal), and 12 steers (+ 3).

Sales.—Three Poll Shorthorn bulls were sold. Three Jersey bulls and a Jersey cow were sold for slaughter.

Rations Beasts.—Two bulls, 20 steers, and 23 females were slaughtered for rations.

Transfers.—One Poll Shorthorn was transferred to Yanco College. The stud sire "Prongorong Icicle" was exchanged for the new sire, "Prongorong Leopold" and a cow, "Prongorong Golden Lilly". Seventeen steers and 13 cows were received from other farms for rations.

SHEEP SECTION

Competitive Exhibits.—At the 1965 Wagga Show, College sheep entries gained four First and two Second placings from seven entries.

DAIRY SECTION

Sales.—Sixteen stud bulls ($2,106), 18 females ($1,060), and five bobby calves ($112) were sold.

A further eleven head were culled, either to the commercial herd or for ration purposes.

Demonstration Cattle.—The demonstration herds are now completed with the inclusion of two Guernsey cows from Yanco and one A.I.S. cow from Grafton.

Production.—Forty-two cows completed test during 1965–66, for a production average of 401 lb B.F./cow; 30 lb B.F. higher than the previous year. Some 9,600 lb of butter was consigned to the Murrumbidgee Dairy Co-op.

Competitive Exhibits.—A Jersey team, and two Ayrshires and two Friesians were exhibited at the Wagga Show. Amongst the awards won was that of Supreme Champion Dairy Cow. A smaller team was shown at the Royal Easter Show, with limited success.

PIGGERY SECTION

Funds for a New Piggery.—Commonwealth funds have been allocated for construction of a new piggery. Plans are in preparation. The work will commence in the new financial year.

Numbers.—At 24th June, 1966, there were 127 in the College herd, compared with 128 a year earlier (the figure "361" in last year's Report was an editing error). During the twelve months 326 pigs were born and two were received from elsewhere; 198 were killed for rations, 41 were marketed, 10 were sold for stud purposes, and 80 were stillborn or died or were destroyed.

Sales.—There were few inquiries. Ten stud pigs were sold.

POULTRY SECTION

Improved Facilities.—An enlarged, modern feed-shed was completed. A fully automatic incubator of 10,200 egg capacity was installed, in a new incubator room fully lined and insulated.

Results from hatches of turkey eggs to date indicate that some previous problems may have been solved by using this modern style of incubator.

The 3rd Random Sample Test (Turkeys).—Results of this are being processed for release to entrants and the public.

APIARY SECTION

Poor Production Year.—The spring honey flow was below expectations. Most hives did little more than make up losses incurred in the previous winter. There was a slightly better than average lift in the early autumn, but mid-autumn flows were again a failure—due partly to the generally dry conditions and partly to some heavy rainstorms experienced late in February and early in March. These storms destroyed blossom which might have been useful.

Effect of Introduced Caucasian-Italian Queens.—The first-cross Caucasian-Italian queens introduced in December, 1964, had seemed to be generally equal to and in some cases better than the Italian queens in the Apiary, but by April, 1966, it was apparent that they are incapable of maintaining a hive during the second year. This experience has been shared by many other beekeepers who in the spring of 1964 obtained similar queens, and it involves thousands of hives in New South Wales and Victoria.

Good success has been obtained by beekeepers who introduced pure Caucasian bees, but these must still be regarded as on trial.

ORCHARD SECTION

Rains in March which broke the dry spell were torrential and caused quite heavy soil erosion in the orchard. Another bad effect was that the rains caused trees in an extremely droughted condition to blossom. Almost all of the blossom buds for the 1966–67 crop of pears, burst and set fruit. Apples, prunes, and almonds were less affected.

Crops.—400 bushels of Granny Smith apples were harvested but were of poor size, and 75 per cent of the total were used for stock food. About three-quarters of a ton of prunes were dried. In the citrus a good crop of navels and Mediterranean sweets were set.

Supplementary Irrigation.—This has had marked effect on tree health on the irrigated five acres of orchard land concerned. It again demonstrated the need for irrigation here.

YANCO AGRICULTURAL COLLEGE AND RESEARCH STATION

Research Activities

These are collated within the reports of the various Divisions that have research personnel at this Station.

Farm Certificate Course

The one-year Course principle has now been firmly established. Public interest in it has grown. The number of applications for entry has increased each year, to 220 for the 102 positions available in 1966. The first intake was in 1963, with 38 students. In 1964 there were 55, and in 1965 there were 85 students.

From reports by ex-students and parents of ex-students it would seem that the course is satisfactorily catering for the needs of boys returning to the land; fulfilling the establishment-aims by conveying a balanced theoretical and practical approach to farming.

STAFFING

The significant change has been the appointment of Mr F. D. Mackenzie, H.D.A., from Farm Manager, as Principal.

1965 CERTIFICATE RESULTS

Of the 84 students in 1965, 74 completed the course and 66 of these gained their certificates.

PROGRESS OF ACCOMMODATION

The second wing of the Pearson Accommodation Block was completed. This provided rooms for 25 students, and allowed the full intake of 102 for 1966.

PROGRESS OF INSTRUCTIONAL FACILITIES

A Farm-buildings Block is under construction. This will be used for the woodwork, metalwork, and farm-buildings course at present given by Leeton Technical College.

A glasshouse for use in the Agronomy and Agrostology Courses is nearing completion.

New lighting, shelving and additions to the Library are progressing, to bring this building up to date. When recently placed book orders to the value of $4,000 are fulfilled the Library should be an efficient unit, subject to the needed appointment of a qualified librarian. The Library is intended to service the research as well as lecturing staff and the students.

A deep-freeze unit has been installed for use in the Veterinary and Animal Husbandry courses. Two electric shearing units and a grinder were generously donated to the College by the Sunbeam Corporation. A mixed, commercial herd of beef cattle has been established for student instruction. Cattle yards have been completed. Proposals for poultry and piggery units have been approved.

About 20 acres of land have been transferred to the Course, for demonstration of irrigation layouts, cultivation methods, and the use of winter forage crops.

R. M. WATTS, Director-General, 19th September, 1966.

APPENDICES

I. Accounts of the N.S.W. Department of Agriculture, 1965–66.

II. The Published Matter of Officers of the N.S.W. Department of Agriculture, 1965–66.

III. Schools and Courses, wherein the N.S.W. Department of Agriculture was a Major Staffing and/or Organizing Element in 1965–66.

APPENDIX I

The Accounts of the Department of Agriculture, 1965–66

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally-owned property is financed from the General Loan Account. In addition to these general classifications of expenditure, the Department is assisted in the financing of certain specified lines of research and development and the control of insect pests and animal diseases by levies on industry and by grants from the Commonwealth Government and public and private organizations. Operations of this nature are reflected in a large number of separate accounts within the general Treasury classification of " Special Deposits Account ", some details of which are given elsewhere in this Appendix.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1964-65	1965-66	Increase or Decrease
	$	$	$
Consolidated Revenue Fund	10,532,764.23	12,637,495.75	2,104,731.52 (Increase)
General Loan Account	519,796.18	285,087.72	234,708.46 (Decrease)
	$11,052,560.41	$12,922,583.47	$1,870,023.06 (Increase)

EXPENDITURE FROM CONSOLIDATED REVENUE FUND

The following tabulation is a comparison of expenditures from Consolidated Revenue Fund by the functional Divisions of the Department for the last two financial years :

Division	1964-65	1965-66	Increase or Decrease
	$	$	$
Central Administration	2,076,170.48	3,345,348.85	1,269,178.37 (Inc.)
Science Services	463,412.11	537,236.95	73,824.84 (Inc.)
Plant Industry	586,601.90	587,413.66	811.76 (Inc.)
Horticulture	609,990.21	598,041.34	11,948.87 (Dec.)
Dairying	570,476.61	574,816.63	4,340.02 (Inc.)
Hawkesbury Agricultural College	595,273.48	587,327.92	7,945.56 (Dec.)
Wagga Agricultural College	323,899.18	342,372.90	18,473.72 (Inc.)
Research Stations	1,175,373.07	1,225,982.14	50,609.07 (Inc.)
Animal Industry—			
Head and District Offices	1,658,270.34	2,053,697.32	395,426.98 (Inc.)
Queensland Border	214,256.62	236,238.14	21,981.52 (Inc.)
Tick Quarantine Areas	1,831,446.97	2,104,058.12	272,611.15 (Inc.)
Royal Botanic Gardens	427,593.26	444,961.78	17,368.52 (Inc.)
	$10,532,764.23	$12,637,495.75 (*a*)	$2,104,731.52 (Inc.)

(*a*) Includes Special Drought Relief Expenditure:

	$
(i) Cartage on Gift Fodder, Road Transport Subsidies, etc.	540,295.64
(ii) Payments to Australian Wheat Board for special movements of wheat resulting from drought	423,216.42
(iii) Cloud Seeding	47,744.68
(iv) Special maintenance and improvement of Public Watering Places in the Western Division	62,673.57
	$1,073,930.31

EXPENDITURE FROM GENERAL LOAN ACCOUNT

Expenditure from General Loan Account for the year was $285,087.72. Of this sum, $78,589.52 was spent on the establishment of the Farm Certificate Course at Yanco Agricultural College and Research Station (making a total of $549,918.90 to the end of this financial year), $21,589.11 for further additions to the Agricultural Research Institute at Wagga and $19,567.01 for a building to house the Milk Re-combining Unit at Hawkesbury Agricultural College School of Dairy Technology.

The following are details of the expenditure on the various works financed from General Loan Account during the financial year 1965-66:

	$
Wagga Agricultural Research Institute—	
Additions—Agronomy Laboratory	21,589.11
Hawkesbury Agricultural College—	
School of Dairy Technology—	
Building to house Milk Re-combining Plant	19,567.01
Cottage	818.72
Wagga Agricultural College—	
Two (2) Cottages	3,266.70
Irrigation	1,418.52
New Dormitory Block	3,316.91
Swimming Pool	1,743.20
Alstonville Tropical Fruit Research Station—	
Glasshouse	4,000.00
Condobolin Agricultural Research Station—	
Erection of Cottage	12,000.00
Dareton Horticultural Research Station—	
Escape Channel	3,536.22
Grafton Agricultural Research Station—	
Glasshouse	9,300.75
Narara Horticultural Research Station—	
Cottage	12,000.00
Tamworth Agricultural Research Station—	
Water Supply	13,000.00
Trangie Agricultural Research Station—	
Erection of Cottage	12,000.00
Yanco Agricultural Research Station—	
Amenities Room	5,185.90
Shed for Cotton Gin and Seed Treatment Plant	15,514.68
Establishment of Farm Certificate Course	78,589.52
Glasshouse	6,097.00
Supply and Erection of Hay Sheds	2,692.00
Glenfield Veterinary Research Station—	
Armidale Veterinary Diagnostic Centre	12,269.58
Laboratories and Conference Room	6,229.59
Modification of Isolation Boxes	6,476.37
Small Animals' Building	10,196.94
Queensland Border—	
Cottage at Boggabilla	12,305.00
Cottage at Mungindi	11,974.00
	$285,087.72

COMMONWEALTH UNEMPLOYMENT RELIEF GRANT

A grant of $6,000.00 was made by the Commonwealth for 1965-66. Of this $4,385.78 was spent in country areas, leaving a balance of $1,614.22 carried forward for the next financial year.

The following table illustrates:

	$
Agricultural Research Station—	
Condobolin	47.60
Cowra	1,203.00
Glen Innes	728.40
Grafton	500.00
Narrabri	836.69
Orange	1,070.09
	$4,385.78

OTHER ACCOUNTS

Special Deposits Account

Following is a complete list of accounts and funds within the Special Deposits Account at the Treasury on which this Department operates:

Name of Account	Balance as at 1st July, 1965	Receipts 1965-66	Payments 1965-66	Balance as at 30th June, 1966
	$	$	$	$
Advances to Officers for purchase of Motor Cars	*Dr.* 219,025.47	112,397.57	110,391.50	*Dr.* 217,019.40
Potato Growers' Licensing Act, 1940	787.31	3,053.57	2,827.80	1,013.08
Commonwealth-State Flood Relief Scheme, 1964	50,291.78	......	181.69	50,110.09
Balance of Salaries Adjustment Suspense Account	129,569.82	166,174.68	129,569.82	166,174.68
Adjustment on Conversion to Decimal Currency Account	......	0.01	0.62	*Dr.* 0.61
Commonwealth-State Bush Fire Relief Scheme, 1965	68,380.00	......	21,389.20	46,990.80
Government Printing Office—Working Account and Stores Account and Sale of Publications	......	1,730.21	87.09	1,643.12
Noxious Insects Destruction Account	87,266.71	77,479.69	115,045.55	49,700.85

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1965	Receipts 1965-66	Payments 1965-66	Balance as at 30th June, 1966
	$	$	$	$
Commonwealth Grant—State Secondary School and Technical Training Projects financed under States' Grant (Science Laboratories and Technical Training) Act, 1964	52,835.48	......	22,835.48	30,000.00
Swine Compensation Fund	200,944.48	148,701.25	13,166.52	336,479.21
Treasury Fire Risks	*Dr.* 32.50	......	14,064.58	*Dr.* 14,097.08
Commonwealth Grant—State Secondary School and Technical Training Projects financed under State's Grants (Technical Training) Act, 1965	......	200,000.00	103,258.98	96,741.02
Hawkesbury Agricultural College Canning Factory Account	3,285.88	4,181.92	3,622.11	3,845.69
Bush Fire and Flood Relief Account (State)	16,757.21	......	2,620.00	14,137.31
Hawkesbury Agricultural College Dairying Factory Working Account	148,391.69	286,918.64	333,866.87	101,443.46
Tobacco Industry Trust Account	7,668.38	19,993.50	19,541.93	8,119.95
Pasture Control Account	20,082.74	......	......	20,082.74
French Bean Seed Marketing Board of New South Wales—Funds upon Dissolution Account	......	1,075.27	642.88	432.39
Potato Marketing Board of New South Wales—Funds upon Dissolution Account	1,178.82	613.44	713.50	1,078.76
Unclaimed Moneys Account	2,713.65	727.51	1,529.29	1,911.87
Commonwealth Grant towards Promotion of Improved Practices in the Dairying Industry	26,800.08	178,104.32	191,301.54	13,602.86
Commonwealth Grant—Expansion of Agricultural Advisory Services, New South Wales	36,504.28	161,168.52	160,582.69	37,090.11
Cattle Compensation Fund	1,570,888.84	551,930.52	355,656.25	1,767,163.11
V. P. Bragg Scholarship—Wagga Agricultural College	289.92	615.00	427.45	477.47
Wagga Agricultural College Swimming Pool Account	8,660.82	12,557.07	20,588.41	629.48
Wheat Industry Stabilization Fund (Disposal) for Research and Extension in the Wheat Industry	13,479.87	83,999.98	71,405.37	26,074.48
V. P. Bragg Scholarship Account (Investment)	12,000.00	......	......	12,000.00
Wagga Agricultural College Swimming Pool Account—Investment Account	11,000.00	......	11,000.00	......
Wheat Industry Stabilization Fund (Disposal) for Research and Extension in the Wheat Industry—Investment Account	168,000.00	......	78,000.00	90,000.00
Additional Poultry Housing for Random Sample Tests at Hawkesbury Agricultural College	*Dr.* 3,811.43	1,270.47	......	*Dr.* 2,540.96
Tuberculosis Eradication Programme	*Dr.* 171.10	......	......	*Dr.* 171.10
Triennial Elections—Wine Grapes Marketing Board for the Shires of Leeton, Wade and Carrathool—1965	......	......	45.08	*Dr.* 45.08
Australian Meat Research Committee Grants—				
Upper River Beef Feed Year Research—North Coast	*Dr.* 82.32	22,670.00	20,270.33	2,317.35
Major and Minor Element Deficiencies in Soils from Beef Areas	2,423.23	1,890.00	2,789.83	1,523.40
Phosphate Levels in North Coast Soils with Specific Relation to Summer Legumes	640.37	10.270.00	11,812.01	*Dr.* 901.64
Pasture Intake and Digestibility Studies—Production of more Beef per acre on Irrigated Pastures	1,906.50	4,471.57	3,904.40	2,473.67
Winter Nutrition on Northern Tablelands	1,398.44	8,378.76	10,114.11	*Dr.* 336.91
Nature and Organization of the Australian Beef Cattle Industry	211.94	5,669.81	4,590.94	1,290.81
Beef Cattle Improvement through Breeding Methods	2,447.70	4,613.83	7,904.84	*Dr.* 843.31
Sod Seeder Development	999.59	3,000.00	2,585.67	1,413.92
Inoculants for Summer Legumes	*Dr.* 27.06	5,900.00	2,393.48	3,479.46
Incidence, Importance and Control of Parasites of Cattle in New South Wales	644.42	1,770.00	1,720.12	694.30
Epidemiology and Control of Fluke Parasites of Cattle in New South Wales	....	1,800.00	......	1,800.00
Bloat Research	*Dr.* 62.20	2,000.00	1,573.94	363.86
Australian Dairy Produce Board—Grant for Research Projects—				
Bacteriophage Antibiotic Interactions	401.20	360.00	374.05	387.15
Composition of Milk	596.52	673.48	990.91	279.09
Efficiency of Detergents	63.42	4,726.58	3,830.24	959.76
Expansion of Other Pasture and Animal Research	*Dr.* 3,969.75	15,048.75	18,754.94	*Dr.* 7,675.94
Expansion of Pasture Species Research	1,977.46	13,097.00	20,523.73	*Dr.* 5,449.27
Flood Irrigation Research, Mooneba	*Dr.* 816.42	2,360.00	1,821.37	*Dr.* 277.79
The Influence of Seasonal Variations in the Compositional Quality of Skim Milk on the Physical and Chemical Qualities of Spray Dried Skim Milk Powder	......	6,840.00	4,432.85	2,407.15
Milking Machines and Mastitis	277.72	42.28	......	320.00
Problems associated with the Manufacture and Keeping Qualities of Process Cheese	......	1,160.00	425.98	734.02
Re-Combining Unit—Hawkesbury Agricultural College	......	20,000.00	......	20,000.00
Socio-economic Investigations	*Dr.* 843.77	12,433.00	11,092.32	496.91
Australian Wool Board Grants—				
Adaptive Pasture Research—Southern Tablelands	2,275.74	12,204.00	12,038.75	2,440.99
Aerial Control of Serrated Tussock—Southern Tablelands	*Dr.* 878.12	4,790.12	4,001.59	*Dr.* 89.59
Aerial Sowing of Pastures	......	2,760.00	1,347.26	1,412.74
Comparison of Management Systems	84.53	3,415.00	2,689.40	810.13
Co-operative Research into treatment of non-arable areas—Serrated Tussock Control	608.59	2,000.00	1,076.28	1,532.31
Developmental Project for the high rainfall region of South-Eastern Australia	......	2,760.00	1,653.40	1,106.60
Economic Investigations of Serrated Tussock Control	......	4,900.00	......	4,900.00

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1965	Receipts 1965-66	Payments 1965-66	Balance as at 30th June, 1966
	$	$	$	$
Australian Wool Board Grants—*continued*—				
Effect of Pasture Management and time of Lambing on Wool and Lamb Production in the South West Wheat Belt of New South Wales	73.22	1,340.78	1,073.38	340.62
Efficiency of Wool Production	9,093.15	11,279.25	18,701.86	1,670.54
Fleece Measurement for Selection of Stud Merino Rams	*Dr.* 683.49	15,083.49	14,715.21	*Dr.* 315.21
Incidence and Prophylaxis of Ewe Infertility due to sub-clover Ingestion	2,700.00	......	2,700.00	......
Influence of Rates of Stocking and Superphosphate Applications on the Productivity of Merino Ewes Grazing Improved Annual Pastures	334.36	2,640.64	1,913.01	1,061.99
Influence of Season on Ram Fertility	672.85	......	553.48	119.37
Investigation of Black Soil Scarab	553.29	1,300.00	464.77	1,388.52
Investigation of Vital Statistics of Yass Valley Merino Flocks	610.16	8,267.84	7,127.60	1,750.40
Overseas Trip—J. M. Holder	......	1,300.00	1,300.00	......
Physiology of Pasture Seeds	......	2,760.00	1,216.99	1,543.01
Research into Control of Insecticidal Resistance in Sheep Blowfly	475.99	3,402.00	2,792.98	1,085.01
Research into Control of Itch Mite in Sheep	*Dr.* 36.08	38.00	......	1.92
Scholarship—I. D. Killeen	......	1,800.00	......	1,800.00
Scholarship—H. C. Kirton	......	1,200.00	1,200.00	......
Scholarship—A. J. Williams	......	2,010.00	......	2,010.00
Sheep Breeding and Pasture Management—Relative Efficiency at Several Stocking Rates and Superphosphate Levels	261.14	5,738.92	5,320.43	679.63
Skin Folds and Ram Fertility	......	800.00	155.40	644.60
Study of Factors limiting Pasture Yield	......	2,760.00	1,735.06	1,024.94
Study of some Factors Influencing Efficiency of Root Nodule Bacteria	......	2,760.00	2,376.93	383.07
Banana Research Committee Grant for Research	1,678.32	6,857.63	7,256.55	1,279.40
Board of Tick Control Employees' Proportion of Contributions to Local Government Superannuation Scheme	16,848.27	33,549.31	36,448.52	13,949.06
Brown Rot Investigations—Trust Fund	1,346.36	......	611.74	734.62
Commonwealth Contribution towards cost of Investigation into Excess Spray Residue on Fruit	1,384.33	10,600.00	10,909.70	1,074.63
Commonwealth Grant—Milking Machine Components Testing Station	*Dr.* 227.37	2,900.00	2,770.68	*Dr.* 98.05
Contribution by Australian Meat Board towards Overseas Visit—J. H. P. Dingle	......	3,000.00	2,877.50	122.50
Contribution by Australian Potash Research Institute for Potash Research	270.00	......	270.00	......
Contribution by Australian Wool Board—Training of Livestock Research Officers	......	1,136.95	901.37	235.58
Contribution by Industry towards Research into Meat Meal Quality at Seven Hills Poultry Research Station	358.78	......	......	358.78
Contribution by Irrigation Research and Extension Committee towards Bird-proof Enclosure at Yanco Agricultural Research Station	......	500.00	500.00	......
Contribution by Metropolitan Water Sewerage and Drainage Board towards Maintenance of Greens, Embankments, etc.—Woollahra and Centennial Park Reservoirs	......	1,000.00	593.55	406.45
Contribution by States towards Salary and Expenses of Patrol Officer—Grasshopper Control	8,223.48	1,620.00	5,469.32	4,374.16
Contribution by Victorian Government for purchase of Concentrates for Starving Stock	......	2,000.00	2,000.00	......
Contribution to Animal Insect Pest Investigations—Glenfield Veterinary Research Station	1,043.39	......	289.36	754.03
Contribution to Pasture Research—Mid Coast and Hunter Region	2,433.98	......	2,389.97	44.01
Contribution towards Development of Tamworth Experiment Station	1,350.23	......	......	1,350.23
Contributions towards Establishment of Library at Agricultural Research Institute, Wagga	16.62	......	......	16.62
Contribution towards Publication of an Australian Bibliography of Agricultural Economics	3,350.00	1,750.00	......	5,100.00
Decimal Currency Conversion Adjustment Account	......	0.02	......	0.02
Department of Agriculture Suspense Account	1,494.59	115,986.58	89.527.06	27,954.11
Donation by Australian Turkey Federation towards Purchase of Incubator	716.00	......	716.00	......
Donation by I.C.I.A.N.Z. towards Pasture Fertilizer Nitrogen Investigations	493.35	......	......	493.35
Geigy Agricultural Chemicals Contribution towards Weedicide Research Project at Hawkesbury Agricultural College	125.30	......	5.08	120.22
Grant by Australian Honey Board for Purchase of Truck	2,900.00	......	2,544.25	355.75
Hawkesbury Agricultural College Egg Laying Competition Prize Fund	1,001.78	2,157.10	1,918.13	1,240.75
Hawkesbury Agricultural College Trust Account	14,131.43	14,174.41	19,072.00	9,233.84
Legume Inoculant Association contribution towards Research and Service in the field of Rhiziobiology	5.45	......	......	5.45
McGarvie Smith Institute—Contribution towards facilities for Glenfield Veterinary Research Station	624.25	......	......	624.25
Manning District Agricultural Research Council—Contribution for Pasture Research in the Manning District	*Dr.* 714.08	3,870.00	2,938.30	217.62
Overseas Visit—R. L. Colman, Agronomist	132.78	230.90	363.68	......
Overseas Visit—B. Owen French	......	4,000.00	......	4,000.00
Overseas Visit—G. R. Gregory	......	1,500.00	......	1,500.00
Pender, W. S. Memorial Fund—Interest on Bonds	201.49	118.00	100.00	219.49

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1965	Receipts 1965-66	Payments 1965-66	Balance as at 30th June, 1966
	$	$	$	$
Reserve Bank of Australia—Grant from Rural Credits Development Fund for Dairy Farm Development on Alluvial and Chocolate Basalt Soils in Richmond Valley	2,267.20	3,720.00	5,049.69	937.51
Reserve Bank of Australia Grant from Rural Credits Development Fund towards Whole Farm Feed Year Studies	*Dr.* 500.55	3,100.00	926.38	1,673.07
Rice Research Laboratory, Yanco	45.00	......	......	45.00
Shannon Vale Nutrition Station Working Account	35,510.72	10,222.97	11,369.45	34,364.24
The Sulphur Institute of U.S.A.—Grant for Compilation, etc., of Results of U.P.S.E.T. Trials	1,685.96	......	93.62	1,592.34
Tobacco Extension Grant to finance additional Extension Work	3,871.76	7,540.00	5,845.20	5,566.56
Tropical Fruit Research Station—Donation by Banana Growers' Federation	4,680.07	......	......	4,680.07
Unclaimed Salaries and Wages	1,873.10	6,363.57	6,867.64	1,369.03
Unemployment Relief Grant, 1965-66	......	6,000.00	4,385.78	1,614.22
Wagga Agricultural College Trust Account	6,259.59	5,136.51	7,330.19	4,065.91
Wallin, D. E.—Trip to U.S.A.	......	3,733.33	29.32	3,704.01
Wheat Industry Research Committee of New South Wales—Grant for—				
Attendance of Dr S. L. Macindoe at Plant Breeding Congress, Sweden	......	600.00	600.00	......
Breeding of Improved Wheat Varieties for Irrigation Areas	621.99	4,800.00	5,387.99	34.00
Contribution of Legumes to the Productivity of Wheat Soils in Northern New South Wales	......	7,400.00	4,331.71	3,068.29
Controlled Environment Chamber for Frost Research	......	10,000.00	9,360.50	639.50
Expanded Wheat Research Projects—Wagga Agricultural Research Institute—Agronomic Survey	2,717.58	7,600.00	16,784.81	*Dr.* 6,467.23
Genetic Analysis of Physiological Components of Maturity of Wheat	*Dr.* 426.12	3,600.00	78.05	3,095.83
Glasshouse for Cytogenetic Investigations	984.00	......	......	984.00
Growth, Development and Yield of Wheat Varieties in relation to date of Sowing and Environment	......	2,000.00	243.75	1,756.25
Insulation and Refrigeration of Cold Room and Heating of Glasshouse, Tamworth	741.00	......	741.00	......
Investigation of Black Soil Scarab	30.62	2,026.00	315.10	1,741.52
Laboratory Equipment, Wagga Agricultural Research Institute	1,559.15	......	990.75	568.40
Machinability of doughs	......	1,200.00	1,024.00	176.00
Mechanism of Frost Resistance	111.54	......	111.54	......
Purchase of Solarimeter	400.00	......	295.80	104.20
Skeleton Weed Research	809.52	1,400.00	1,685.23	524.29
Soft Wheat Quality Programme—Central West	2,551.10	......	62.72	2,488.38
Soil Fertility	991.59	1,200.00	2,534.22	*Dr.* 342.63
Temperature Control in Glasshouse, Tamworth	4,600.00	391.25	4,991.25	......
Temperature Controlled Growth Chamber	4,000.00	......	4,000.00	......
Travel and Capital Expenditure—Dr A. T. Pugsley and G. M. Halloran	431.38	......	......	431.38
Visit to New Zealand of a Soil Chemist	15.04	......	15.04	......
Wheat Breeding—Temora	400.00	......	......	400.00
Wheat Frost Research, overseas travel—W. V. Single	......	2,000.00	2,000.00	......
Wheat Research in the Central West	1,588.98	20,000.00	16,600.01	4,988.97
Wheat Industry Research Council Grant—				
Extensions, Agricultural Research Institute, Wagga	16,000.00	......	5,479.66	10,520.34
Economics of Segregation and Storage of Wheat	1,555.67	2,500.00	3,764.65	291.02
The use of first generation Hybrid Seed for Commercial Wheat Production	......	1,624.00	819.38	804.62
Improvement of Durum Wheat Varieties	196.70	6,629.13	4,069.34	2,756.49
Investigation into Possibilities of Segregation of Wheats on the basis of Quality—Wheat Growing Survey	2,234.77	......	534.61	1,700.16
Investigation of Varietal Differences in the major components of baking quality	......	3,700.00	......	3,700.00
Photo-period and Temperature Studies	793.96	6,688.00	7,510.70	*Dr.* 28.74
Wheat Collecting Expedition to Afghanistan	......	2,611.30	2,611.30	......
Wheat Frost Research, overseas travel—W. V. Single	......	2,000.00	1,278.32	721.68
World Wheat Collections—Australian Conference	......	500.00	......	500.00
Yellow Dwarf Virus	215.02	84.98	37.23	262.77
Yanco Agricultural Research Station Trust Account	4,961.18	4,572.60	3,940.42	5,593.36
Total $	2,602,035.93	2,607,072.78	2,336,991.15	2,872,117.56

Commonwealth Grant for Science Laboratories and Technical Training

The year 1965-66 was the second year of plan for providing additional education facilities under this grant. Of $52,835.48 carried forward from 1964-65, $22,835.48 was spent, leaving a balance of $30,000.

Commonwealth Grant for State Secondary School and Technical Training Projects

This grant, $200,000 for 1965-66, has been given under the provisions of the Commonwealth States' Grants (Technical Training) Act 1965.

A three-year plan, involving a total expenditure on technical training facilities amounting to $600,000 has been evolved. Of the $200,000 received in the current financial year, $103,258.98 has been spent as under:

	$	$	$
Buildings—			
Hawkesbury Agricultural College—			
Animal Nutrition Unit	14,623.00		
Renovation of Science Block	5,528.00		
Glasshouse	7,894.75		
		28,045.75	
Wagga Agricultural College—			
Woolclassing Unit	17,866.25		
Welding Workshop Extensions	5,939.33		
Animal Nutrition Unit	11,718.48		
Glasshouse	8,795.50		
		44,319.56	
Yanco Agricultural College—			
Metalwork and Farm Building Instruction Workshop	....	7,690.00	
Total Buildings			80,055.31
Equipment—			
Hawkesbury Agricultural College	....	2,494.94	
Wagga Agricultural College	....	20,708.73	
Total Equipment			23,203.67
Total Expenditure			103,258.98

Swine Compensation Fund

	$
Balance as at 1st July, 1965	200,944.48
Receipts—Stamp Duty	148,701.25
	$349,645.73
Payments—Swine Compensation	13,166.52
Balance as at 30th June, 1966	$336,479.21

Cattle Compensation Fund

SUMMARY OF RECEIPTS AND PAYMENTS

	$	$	$
Balance as at 1st July, 1965			1,570,888.84
Add Receipts—			
Levy		338,678.20	
Sale of Stamps		173,252.31	
Interest on Accumulated Funds		40,000.00	
			551,930.51
			2,122,819.35
Deduct Payments—			
Compensation		324,623.22	
Administrative Costs—			
Valuation Fees	8.40		
Allowances to Secretaries of Pastures Protection Boards	5,326.00		
Department of Agriculture	25,698.62		
		31,033.02	
			355,656.24
Balance as at 30th June, 1966			$1,767,163.11

The following statistical information is furnished in connection with the payment of compensation:

Disease	Claims			Animals			Payments		
	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total
							$	$	$
Tuberculosis	597	407	1,004	1,810	524	2,334	64,009.95	32,909.73	96,919.68
Cancer	3,156	315	3,471	4,168	379	4,547	115,199.56	17,174.97	132,374.53
Actinomycosis	2,161	15	2,176	2,522	16	2,538	63,759.94	343.71	64,103.65
Actinobacillosis	853	10	863	1,031	10	1,041	23,774.38	459.78	24,234.16
Pleuropneumonia contagiosa	2	..	2	2	..	2	120.00	....	120.00
Trichomoniasis	..	..	..	..	..	..	....	....	....
Tick Fever	89	..	89	179	..	179	6,702.90	....	6,702.90
Johne's Disease	3	..	3	3	..	3	168.30	....	168.30
Vibriosis	..	..	..	..	..	..	....	....	....
Totals	6,861	747	7,608	9,715	929	10,644	$273,735.03	$50,888.19	$324,623.22

Commonwealth Dairy Industry Extension Grant

The agreement for the continuance of this grant, terms, and conditions of which were set out in the Department's report for the year ended 30th June, 1953, is current until 30th June, 1968.

The first grant was received in October, 1948, and expenditure to 30th June, 1966, has amounted to $2,450,998.61, details of which are as under:

Item	1948-49 to 1964-65	1965-66	Total
	$	$	$
Organizing Officers	378,110.78	26,068.35	404,179.13
General Publicity	227,082.57	21,803.47	248,886.04
Demonstrations	370,806.08	14,464.73	385,270.81
Competitions	14,874.73	....	14,874.73
Field Days	177.56	....	177.56
Herd Recording	727,028.85	71,200.00	798,228.85
Artificial Insemination	120,151.52	....	120,151.52
Statistical Work	36,068.18	....	36,068.18
Herd Surveys	52,330.67	....	52,330.67
Punch Card Equipment	66,536.92	2,884.30	69,421.22
Milking Machine Survey	124,819.20	25,138.66	149.957.86
Milking Machine Testing Station	9,765.44	....	9,765.44
Survey—Infertility in Dairy Herds	22,243.61	....	22,243.61
Agricultural Trainees	80,000.00	16,000.00	96,000.00
Sire Survey	10,011.42	1,546.96	11,558.38
Testing Stations—Air Flow Meters	498.21	....	498.21
Overseas Visits—Departmental Officers	13,191.34	12,195.06	25,386.40
Publication of Book—*Weeds*	6,000.00	....	6,000.00
	$2,259,697.08	191,301.53	2,450,998.61

Commonwealth Grant—Expansion Agricultural Advisory Services

The previous agreement expired 30th June, 1965 and no new agreement, as such, was entered into. As a temporary arrangement the grant was continued at the previous rate of $150,000 for the year.

Expenditure from the commencement of the agreements to 30th June, 1966, is shown below:

Item	1948-49 to 1964-65	1965-66	Total
	$	$	$
Crop and Pasture Demonstrations	185,038.20	985.79	186,023.99
Livestock Demonstrations	68,820.74	4,275.28	73,096.02
Horticultural Demonstrations	40,434.65	3,615.23	44,049.88
Agricultural Machinery Demonstrations	78,707.22	18,592.97	97,300.19
Irrigation Equipment and Demonstrations	2,201.64	....	2,201.64
Field Assistants and Motor Vehicles	586,832.22	55,849.17	642,681.39
Extension Aids Equipment	100,050.38	1,845.15	101,895,53
Publicity Officers	302,716.82	48,369.55	351,086.37
Production of Agricultural Publications	79,046.72	2,444.00	81,490.72
Production of Agricultural Films	5,741.71	....	5,741.71
Purchase of Books	25,099.60	2,489.85	27,589.45
Overseas Visits of Agricultural Officers	19,322.67	5,500.00	24,822.67
Agricultural Trainees and Cadets	156,623.33	14,455.19	171,078.52
Administration	24,497.98	1,550.41	26,048.39
Water and Soil Testing	11,708.72	610.10	12,318.82
$	1,686,842.60	160,582.69	1,847,425.29

Noxious Insects Destruction Account

The Noxious Insects Act, 1934, provides for striking a levy under specified conditions. Monies received are paid into Special Deposits Account and these are applied by the Minister for the purposes prescribed by the Act.

The 1965-66 Statement of Receipts and Payments is as under:

RECEIPTS		PAYMENTS	
	$		$
Levies	77,479.69	Poisons, Materials and Sundry Purchases	115,045.55
Balance as at 1st July, 1966	87,266.71	Balance as at 30th June, 1966	49,700.85
	$164,746.40		$164,746.40

Potato Growers' Licensing Act, 1940 (as amended)

Transactions on this account for the year 1965-66 were as follows:

RECEIPTS		PAYMENTS	
	$		$
Balance as at 1st July, 1965	787.31	Grants to Potato Growers' Association	2,800.00
Licence Fees	3,053.57	Printing	27.80
		Balance as at 30th June, 1966	1,013.08
	$3,840.88		$3,840.88

Shannon Vale Nutrition Station—Working Account

The following is the Statement of Receipts and Payments for the year ended 30th June, 1966:

RECEIPTS	$	PAYMENTS	$
Balance as at 1st July, 1965	35,510.72	Wages	3,400.68
Sale of Wool	9,227.83	Shearing	802.88
Sale of Sheep	851.45	Workers' Compensation Insurance	67.92
Sale of Sheepskins	143.69	Payroll Tax	89.57
Refund Returnable Containers	56.00	Freight and Cartage	1,512.40
		Motor Fuel	231.65
		Vaccines and Drenches	924.86
		Fodder	2,091.51
		Equipment	571.61
		General Supplies	1,679.37
		Plant Repairs	53.00
		Balance as at 30th June, 1966	34,364.24
	$45,789.69		$45,789.69

OTHER ACCOUNTS

Veterinary Surgeons Act, No. 25 of 1923 (as amended)

The Act provides for the establishment of the "Board of Veterinary Surgeons of New South Wales". Fees and penalties collected under the Act are paid to the credit of the Consolidated Revenue Fund, from which the administrative expenses of the Board are met.

As at 30th June, 1966, 567 Veterinary Surgeons were registered.

The Statement of Receipts and Payments for the year ended 30th June, 1966, is as under:

RECEIPTS	$	PAYMENTS	$
Registration Fees	142.84	Salaries	1,842.89
Roll Fees	2,449.63	Members' Fees	336.00
Restoration Fees	12.60	Travelling Expenses	38.94
Examination Fees	126.00	Postal Expenses	88.16
		Examination Fees Foreign Graduates	126.00
		Printing	17.41
		Minor Expenses	9.62
		Excess of Receipts over Payments	272.05
	$2,731.07		$2,731.07

Meat Inspection Service

This service is administered under the Meat Industry Act, 1915 (as amended), and which makes provision for inspection fees.

The following is a Statement of Receipts and Payments on behalf of the Service for the year ended 30th June, 1966:

RECEIPTS	$	PAYMENTS	$
Inspection Fees—		Salaries and Wages	716,869.74
Regulation No. 7	450,235.72	Casual Labour	8,845.96
Regulation No. 8	114,548.99	Allowances	382.42
Regulation No. 9	232,527.38	Retirement Leave	2,970.74
Regulation No. 10	11,194.22	Tea Money	15.60
		Metropolitan Meat Industry Board Endowment Fund Contribution	5,809.49
		Rent	1,144.52
		Travelling Expenses	52,124.15
		Motor Vehicle Running Costs	218.11
		Freight and Cartage	159.80
		Books and Periodicals	121.22
		Postal and Telephone Expenses	849.74
		Fees for Service Rendered	135.00
		General Stores	2,132.16
		Gas and Electricity	15.76
		Printing	706.71
		Surplus of Receipts over Payments	16,005.19
	$808,506.31		$808,506.31

While there was a surplus of receipts over payments, overhead expenses amounting to $145,143.14 have not been taken into account. These include employer's superannuation contribution, workers' compensation insurance and payroll tax, calculated at 20 per cent of cost of salaries and wages ($725,715.70). If this figure is taken into account there is a deficiency of $129,137.95.

Fund Created by Wheat Marketing (Barring of Claims) Act, No. 22 of 1929 (as amended)

REVENUE ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1966

	$	$		$
To Commitment Disbursement ..	2,000.00		By Interest on Investments (including Savings Bank Interest)	4,627.88
Less Miscellaneous Repayments	310.78			
		1,689.22		
Balance—Net Surplus transferred to Accumulated Funds Account		2,938.66		
		$4,627.88		$4,627.88

BALANCE-SHEET AS AT 30TH JUNE, 1966

LIABILITIES	$	$	ASSETS	$
Accumulated Funds—			Investments in Government Securities (face value)	91,100.00
Balance as at 1st July, 1965	93,923.87		Matured Investments (for re-investments)	2,500.00
Net surplus for year ended 30th June, 1966	2,938.66		Balance in Savings Bank	3,542.05
		96,862.53	Interest accrued at 30th June, 1966	920.49
Commitments as at 30th June, 1966		1,200.00		
		$98,062,53		$98,062.53

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND—FINANCIAL YEAR 1965-66

Head of Receipt	Net Receipts		
	$	$	$
Receipts for Services Rendered—			
Agricultural Colleges and Farms—			
Rents	54,482.73		
Students' Fees	156,971.86		
		211,454.59	
Fees—			
Public Officers	20.70		
Witness' Expenses	56.60		
Apiary Registration	4,861.26		
Grading—Dairy Industry Act	154.37		
Licence—Dairy Industry Act	20.00		
Registration—Dairy Industry Act	108.00		
Dairy Science Schools	1,513.50		
Farm Produce Agents' Act, 1926-1932	602.00		
Fertilizer Act, 1934	1,524.60		
Pest Destroyers Act, 1945	3,712.40		
Registration of Stock Brands	4,388.62		
Registration of Swine Brands	304.71		
Stock Foods and Medicines Act, 1940	9,942.50		
Veterinary Surgeons' Act, 1923	2,731.07		
		29,940.33	
Contributions—			
New South Wales Milk Board—T.B. Testing of Herds	11,537.09		
Commonwealth Government—Administration of Plant Quarantine	141,146.07		
Commonwealth Government—Administration of Animal Quarantine	70,323.26		
Commonwealth Government—Administration of Commerce Act..	72,085.28		
Commonwealth Government—Maintenance of Gardens at Admiralty House	15,506.60		
		310,598.30	
Miscellaneous Services Rendered—			
Plant Diseases Act—Inspection Fees and Fumigation Fees	786.70		
Meat Industry Act—Inspection Fees	808,506.31		
Commonwealth Scientific and Industrial Research Organisation—Subsidy—Vegetable Growing at Hawkesbury Agricultural College	1,000.00		
Laundry Fees—Hawkesbury Agricultural College and Yanco Agricultural College and Research Station	6,191.00		
Certification of Seed	19,571.02		
Seed Testing	833.91		
Herd Recording	128,672.40		
Administration of Cattle Compensation Fund	25,698.62		
Commission for Collection of Premiums—Group Assurance, Hospital and Medical Funds	4,095.79		
Other Miscellaneous Receipts	37,676.09		
		1,033,031.84	
			1,585,025.06

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND—FINANCIAL YEAR 1965-66—*continued*

Head of Receipt	Net Receipts		
	$	$	$
General Miscellaneous Receipts—			
Rents exclusive of land	7,762.50		
Fines and Forfeitures	11,102.46		
Sale of Farm Produce—Farms and Institutions	323,865.58		
Sale of Government Property	16,678.20		
Commonwealth Government—Contribution for Cattle Tick Control	348,184.00		
Repayment to credit of Consolidated Revenue Funds—Previous Years	162,985.38		
Miscellaneous Receipts on account of Interest	190.58		
Transfer of Part Balances not required	47.68 *Dr.*		
Licence Fees—Pastures Protection Act	7.00		
Broadcasting Fees	28.00		
Gas and Electricity	7,755.83		
Lavatory Takings	159.28		
Postages	108.20		
Telephone Calls (Private)	3,013.13		
3 per cent Contribution—Pastures Protection Boards	57,861.12		
Employer's Liability to State Superannuation Fund	4,984.39		
Conscience Money	2.00		
Commonwealth Grant towards cost of Herd Recording	71,200.00		
Other Miscellaneous Receipts	238.70		
		1,016,078.67	
			1,016,078.67
			$2,601,103.73

DAIRY PRODUCTS FACTORY—HAWKESBURY AGRICULTURAL COLLEGE

The operations of the Dairy Products Factory for the financial year 1965-66 resulted in a loss of $38,693.94.

Abridged final accounts are set out hereunder:

Manufacturing and Trading Account

	$		$
Stock on hand at 1st July, 1965	1,640.47	Sales	244,116.56
Purchases	197,933.74	Stock on hand at 30th June, 1966	7,058.09
Repairs and Maintenance	10,169.03	Gross Loss	9,736.07
Fuel, Light, and Power	7,344.15		
Water	1,772.35		
Salaries and Wages	17,614.05		
Workers' Compensation Insurance Premiums	244.08		
Payroll Tax	439.44		
Superannuation—Employer's Liability	1,750.57		
Depreciation	21,608.27		
Sundry Expenditure	394.57		
	$260,910.72		$260,910.72

Profit and Loss Account

	$		$
Gross Loss from Manufacturing and Trading Account	9,736.07	Sundry Income	95.28
Salaries and Wages	7,830.54	Net Loss	38,693.94
Payroll Tax	195.36		
Workers' Compensation Insurance Premium	108.50		
Superannuation—Employer's Liability	442.13		
Levies—Butter and Cheese	459.49		
Printing and Stationery	117.13		
Freight and Cartage	202.64		
Laboratory Expenses	120.61		
Repairs and Maintenance	375.93		
Telephone	273.90		
Depreciation	1,571.28		
General Expenses	75.25		
Interest on Capital	17,280.39		
	$38,789.22		$38,789.22

Appropriation Account

	$		$
Loss on Disposal of Plant	284.79	Balance as at 1st July, 1965	54,157.04
Net Loss 1965-66	38,693.94	Expenditure not met from Working Account	23,097.17
Balance as at 30th June, 1966	38,275.48		
	$77,254.21		$77,254.21

APPENDIX II

Published Matter*, 1965-66

*Viz.:—Matter printed as Department of Agriculture (D. of A.) booklets, or contributed to and printed as articles either in Department of Agriculture journals (the monthly *Agricultural Gazette of N.S.W.*, quarterly *Review of Marketing and Agricultural Economics*, bi-monthly *Dairy Topics*, monthly *Poultry Notes*, biannual *Veterinary Notes*, the periodical *Research and the Farmer*) or the journals of other institutions/organizations; and papers published in the proceedings of technical conferences.

The Appendix does not list the many times greater volume of items contributed in the course of extension work through such channels as the Department's weekly printed *Press Copy*, *Weekly Marketing Notes*, *New South Wales Pastoral Conditions* and *Report on Production Trends* of the Division of Marketing and Agricultural Economics, and the Regional/District publicity releases for newspapers and radio stations. Indications of the volume of this published matter are included in this report under "Division of Information Services" and "Regional Extension Services".

A. RESEARCH STATIONS BRANCH—FARM MECHANIZATION ADVISORY SERVICE

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Drever, J. G. J. (1965).—Chain saws. (Bulletin 54.)

Finlayson, W. H., and Drever, J. G. J. (1965).—Systematic maintenance of farm machinery. (Bulletin 55.)

Contributions to Journals

Anon. (1965).—Buying used tractors. Agric. Gaz. N.S.W. 76 (11): 666.

Anon. (1966).—Care prolongs tyre life. Agric. Gaz. N.S.W. 77 (1): 10.

Anon. (1965).—Getting the best from your header. Agric. Gaz. N.S.W. 76 (10); inside front cover.

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Anon. (1965).—Home orchard calendar. (Bulletin H. 1.)

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Fuller, E. J. (1966).—Handling and packing apples. (Bulletin H. 33.)

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APPENDIX III

Schools and Courses wherein the N.S.W. Department of Agriculture was a Major Staffing and/or Organizing Element in 1965–66

Subject-Matter	Type* (School or Course)	Location	Sponsor and/or Organizing Associate	Attendance	Duration
Public Speaking and Meeting Procedure.	School	Ingleburn	Nepean C.W.A. Group	41	3 days.
	School	Narrandera	Sturt C.W.A. Group	40	3 days.
	School	Baradine	Agricultural Bureau	24	3 days.
	School	Gilgandra	Macquarie C.W.A. Group	41	3 days.
	School	Gosford	Northumberland C.W.A. Group.	78	1 day.
Soils and Botany	School	Ariah Park	Agricultural Bureau	41	3 days.
	Course	Merriwa	Agricultural Bureau	37	5 nights (5 weeks).
	Course	Arcadia	Agricultural Bureau	43	5 nights (5 weeks).
	Course	Bingara	Agricultural Bureau	55	5 nights (5 weeks).
	Course	Boorowa	Agricultural Bureau	40	5 nights (5 weeks).
	Course	Coleambally	Agricultural Bureau	40	5 nights (5 weeks).
	Course	Dubbo	Agricultural Bureau	61	5 nights (5 weeks).
	Course	Forbes	Agricultural Bureau	25	5 nights (5 weeks).
	Course	Inverell	Agricultural Bureau	84	5 nights (5 weeks).
	Course	Millthorpe	Agricultural Bureau	32	5 nights (5 weeks).
	Course	Wellington	Agricultural Bureau	36	5 nights (5 weeks).
Farm Management	School	Bombala	Agricultural Bureau	27	3 days.
	School	Mudgee	Agricultural Bureau	36	3 days.
	School	Wagga Agric. Col.	Department of Agriculture	46	5 days.
	School	Inveralochy	Various Farmer Organizations	40	4 days.
	School	Armidale	Univ. of New England	45	4 days.
	Course	Coleambally	Agricultural Bureau		4 nights (4 weeks).
	Course	Griffith		38	4 nights (4 weeks).
Pasture Production and Utilization.	School	Murrumbateman	Agricultural Bureau	50	2 days.
Pasture Improvement	School	Dubbo	Agricultural Bureau	71	2 days.
Pasture Utilization	School	Coonabarabran	Agricultural Bureau	37	1 day.
Pastures	School	Mullion Creek	Agricultural Bureau	40	2 days.
Winter Pasture	School	Fairy Hill	Agricultural Bureau	35	1 day.
Weeds	School	Orange	Department of Agriculture	45	3 days.
Crops—					
Summer Crops	School	Coonabarabran	Agricultural Bureau	110	1 day.
Cereal Production	School	West Wyalong	United Farmers & Woolgrowers Association.	40	3 days.
Wheat Production	School	Bellata	United Farmers & Woolgrowers Association.	160	1 day.
Fertilizer	School	Baradine	Agricultural Bureau	46	2 days.
	School	Inverell	Agricultural Bureau	120	2 days.
	School	Gunnedah	Agricultural Bureau	50	1 day.
Irrigation	School	Forbes	Agricultural Bureau	64	3 days.
	School	Inverell	Agricultural Bureau	100	2 days.
	School	Narromine	Agricultural Bureau	108	2 days.
	School	Curlewis	Department of Agriculture	150	1 day.
	School	Quirindi	Department of Agriculture	65	1 day.
	Course	Wyong	Agricultural Bureau	40	6 nights (6 weeks).
Orchard Irrigation	School	Bilpin	Agricultural Bureau	38	1 day.
	School	Oakdale	Agricultural Bureau	63	1 day.
Sheep and Wool—					
Prime Lamb Raising	School	Lake Cargelligo	Agricultural Bureau	75	1 day.
	School	West Wyalong	Agricultural Bureau	90	1 day.

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* The word "Course" as distinct from "School", is reserved in this context for the occasions where the enrolled people attend one night per week for a prescribed number of weeks.

"School" in this context refers to the occasions where the enrolled people attend for a day or, as the case may be, a prescribed number of consecutive days.

Schools and Courses wherein the N.S.W. Department of Agriculture was a Major Staffing and/or Organizing Element in 1965-66—*continued*

Subject-Matter	Type* (School or Course)	Location	Sponsor and/or Organizing Associate	Attendance	Duration
Sheep and Wool—*continued*—					
Sheep Nutrition	School	Millthorpe	Agricultural Bureau	28	2 days.
Sheep and Cattle Reproduction.	School	Merriwa	Agricultural Bureau	70	2 days.
Sheep Nutrition	School	Coonabarabran	Agricultural Bureau	35	2 days.
	School	Forbes	Agricultural Bureau	55	2 days.
Wool Production and Marketing.	School	Boorowa	Agricultural Bureau	37	2 days.
Dairy Cattle Diseases and Management.	School	Wauchope	Agricultural Bureau	65	1 day.
Dairy Cattle Health	Course	Bowraville	Agricultural Bureau	28	5 nights (5 weeks).
	Course	Coffs Harbour	Agricultural Bureau	27	5 nights (5 weeks).
Dairy Husbandry	School	Taree	Manning District Agricultural Research Council.	65	2 days.
Dairy Farming	School	Hawkesbury Agric. College.	Department of Agriculture	26	4 days.
Horticulture	School	Batlow	Department of Agriculture	60	1 day.
Drought Feeding	School	Dubbo	Agricultural Bureau	120	1 day.
	School	Grafton	Department of Agriculture	65	1 day.
	School	Condobolin	Condobolin Rural Advisory Group.	40	1 day.
	School	Moree	Department of Agriculture	60	1 day.
	School	Mallanganee	Department of Agriculture		1 day.
	School	Dyraaba	Department of Agriculture		1 day.
Fodder Conservation	School	Bingara	Agricultural Bureau	25	2 days.
Supplementary Feeding	School	Boorowa	Agricultural Bureau	40	1 day.
Stock Nutrition	School	Adelong	Agricultural Bureau	12	1 day.
	School	Coolac	Department of Agriculture	6	1 day.
	School	Coolamon	Department of Agriculture	60	1 day.
	School	Holbrook	Department of Agriculture	70	1 day.
	School	Lockhart	Department of Agriculture	96	1 day.
	School	Temora	Department of Agriculture	20	1 day.
	School	Walbundrie	Department of Agriculture	80	1 day.
Tractor Maintenance	School	Coleambally	Agricultural Bureau	25	1 day.
	School	Brown's Creek	Agricultural Bureau	28	1 day.
	School	Dungog	Agricultural Bureau	21	1 day.
	School	Hampton	Agricultural Bureau	27	1 day.
	School	Morpeth	Agricultural Bureau	43	1 day.
	School	Mullion Creek	Agricultural Bureau	18	1 day.
	School	Singleton	Agricultural Bureau	16	1 day.
	School	Hillston	Graziers Association	35	1 day.
	School	Oaklands	Graziers Association	60	1 day.
Welding	School	Carabost	Agricultural Bureau	18	1 day.
	School	Lankey's Creek	Agricultural Bureau	20	1 day.
	School	Lowther	Agricultural Bureau	15	1 day.
	School	Tarcutta	Australian Primary Producers Union.	20	1 day.
	School	Yanco Agricultural College.	Leeton Engineering Society	60	1 day.
Rural Finance	School	Muswellbrook	Agricultural Bureau	157	1 day.
Turkey Production	School	Wagga Agric. College.	Turkey Producers' Fed.	53	4 days.
Beekeeping	School	Hawkesbury Agric. College.	Department of Agriculture	21	5 days.
Pig Raising	School	Hawkesbury Agric. College.	Department of Agriculture	37	5 days.
Vegetable Production	School	Bathurst	Agricultural Bureau	43	2 days.
FOR JUNIOR FARMERS					
Sheep and Agronomy	School	Wagga Agric. College.	Junior Farmer Clubs	19	5 days.
Pasture Improvement	School	Hawkesbury Agric. College.	Junior Farmer Clubs	19	5 days.
Poultry	School	Hawkesbury Agric. College.	Junior Farmer Clubs	19	5 days.

Schools and Courses wherein the N.S.W. Department of Agriculture was a Major Staffing and/or Organizing Element in 1965-66—*continued*

Subject-Matter	Type* (School or Course)	Location	Sponsor and/or Organizing Associate	Attendance	Duration
FOR INDUSTRY OPERATIVES—					
Dairy Factory Apprentices	School	Hawkesbury Agric. College.	Department of Agriculture	40	5 days.
Dairy Science	School	Lismore	Department of Agriculture	41	5 days.
Dairy Science	School	Nowra	Department of Agriculture	14	4 days.
Dairy Science	School	Singleton	Department of Agriculture	26	4 days.
Dairy Science	School	Taree	Department of Agriculture	21	4 days.
Food Factory Foremen	School	Hawkesbury Agric. College.	Department of Agriculture	17	5 days.
Milk Grading	School	Albury	Department of Agriculture	4	4 days.
Milk Grading	School	Camden	Department of Agriculture	9	3 days.
Milk Grading	School	Camden	Department of Agriculture	9	4 days.
Milk Grading	School	Penrith	Department of Agriculture	10	3 days.
Milk Grading	School	Penrith (for H.A.C. students).	Department of Agriculture	18	3 days.
Milk Grading	School	Wauchope	Department of Agriculture	7	4 days.
Dairy Factory Operatives	School	Hawkesbury Agric. College.	Department of Agriculture	17	5 days.
IN-SERVICE TRAINING—					
Herd Recorders	School	Hawkesbury Agric. College.	Department of Agriculture	33	4 days.
Dairy Technology	School	Taree	Department of Agriculture	29	5 days.
Extension Aids	School	Wagga	Department of Agriculture	15	2 days.
Extension Methods	School	Hawkesbury Agric. College.	Department of Agriculture	40	2 weeks.
Farm Management	School	Grafton	Department of Agriculture	34	5 days.
University and College Trainee Induction.	School	Bathurst	Department of Agriculture	73	10 days.
Television in Extension	School	Orange	Department of Agriculture	30	2 days.
Television in Extension	School	Tamworth	Department of Agriculture	12	4 days.
Weeds (Research Agronomists).	School	Hawkesbury Agric. College.	Department of Agriculture	8	3 days.
Communication Principles and Practice.	School	Canberra	C.S.I.R.O.	31	5 days.
Extension Service Principles and Methods.	School	Narrabeen	University of New England	69	6 days.
HOMEMAKER TOPICS—					
Home Furnishing and Decorating.	School	Lankey's Creek	Agricultural Bureau	22	......
	School	Yarramalong	Agricultural Bureau	34	......
	School	Bombala	Agricultural Bureau (Ando-Mila).	83	......
	School	Dalgety	Red Cross	13	......
	School	Mullion Creek	Agricultural Bureau	41	......
	School	Mangoplah	C.W.A.	27	......
	School	Forbes	Agricultural Bureau (Southern Cross).	56	......
Home Nursing	School	West Trundle	Agricultural Bureau	30	......
	School	Kiacatoo	Agricultural Bureau	38	......
	School	Dubbo	Agricultural Bureau	20	......
	School	Dooralong	Agricultural Bureau	26	......
	School	Baradine	Agricultural Bureau	36	......
	School	Orangeville	Agricultural Bureau	26	......
	School	Millthorpe	Agricultural Bureau	30	......
Personality with Poise	School	Winchenden Vale	Agricultural Bureau	12	......
	School	Inverell	Agricultural Bureau	52	......
	School	Taylor's Arm	C.W.A.	40	......
	School	Dubbo	C.W.A.	56	......
Steps to Better Dressmaking	School	Courabyra	C.W.A.	36	......
	School	Cooma	Red Cross	23	......
	School	Mittagong	Infants Mothers Club	50	......
	School	Berridale	Agricultural Bureau	20	......
Planned Work, More Leisure.	School	Bingara	Agricultural Bureau	45	......
	School	Warialda	C.W.A.	23	......
Hair Care	School	Coonamble	Far West Children's Health Scheme.	34	......
	School	Baradine	Agricultural Bureau	56	......
Cold Climate Gardening	School	Blayney	C.W.A.	92	......
Understanding Ourselves	School	Dubbo	Presbyterian Women	57	......
	School	Mannus	C.W.A.	37	......
Floral Art	School	Wellington	Agricultural Bureau	46	......
Pattern Adjustment	School	Mittagong	Infants' Mothers Club	20	......
Wardrobe Planning	School	Rye Park	Agricultural Bureau	15	......